OFFSET LITHOGRAPHY

PHOTO LITHOGRAPHY
TIN PLATE DECORATING

WARREN C. BROWNE

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[SECOND EDITION]

OFFSET LITHOGRAPHY

A TREATISE ON

Printing in the Lithographic Manner
from Metal Plates on Rubber Blanket
Offset Presses.

WITH WHICH IS INCORPORATED

A Comprehensive Digest on

PHOTO-LITHOGRAPHY

AND ALSO ON

TIN PLATE DECORATING

Compiled and edited in the office of
the National Lithographer
BY
WARREN C. BROWNE

424486
9.6.44

New York
The National Lithographer
1922

FOREWORD

During the recent past we have had many inquiries for a text-book on offset lithography. We have sold several hundred books of various kinds that have devoted more or less space to offset printing, but none of them have exploited the subject so thoroughly as we believe it should be. Therefore, we have compiled and published this book, which we call "Offset Lithography."

In its compilation we have quoted freely from "Metal Plate Printing," by the same author, and have also quoted from the writings of many expert workers in the offset line. We have also used the information contained in various articles which have appeared recently in the NATIONAL LITHOGRAPHER, and have endeavored to make this volume as plain and understandable as our knowledge of the English language permits. We have tried to avoid, as far as possible, all chemical and scientific technical terms, substituting plain English where the information could be conveyed in that way.

In offering this book to the trade, we do it feeling that it will supply a want. That the many workers who are in need of information along this line may be able to find it between these covers we hope and trust.

As Photo-Lithography is becoming more and more an adjunct to offset printing, it has been deemed expedient to add a digest of that process to this work, that the offset worker may keep in touch with the camera and its important and rapidly growing service in modern lithography.

As Tin Plate Decorating is all done by the offset process we feel that it also deserves a place in this volume and have included a concise and thorough chapter.

WARREN C. BROWNE.

New York City,
1917.

FOREWORD TO SECOND EDITION

When this book was first offered to the lithographic public, in 1917, there was some doubt in the mind of its publisher as to whether there would be a demand for it that would result in sales enough to pay the cost of publication. At that time the offset press was being adopted by commercial lithographers, and being experimented with in color houses. Now the offset press is in use in practically every lithographic establishment in the United States, and the 1917 edition of "Offset Lithography" is entirely exhausted. Constant demands for copies of the book have induced us to issue this second edition. The close reader will find some changes in the text of this new edition and some additions to the information the first edition contained. It will be found interesting and instructive to every man who is connected with a lithographic establishment in any capacity. The apprentice who is learning the trade should not be without it, because it answers many of the questions which he is bound to ask. The journeyman will be interested in comparing the way lithographing is done now to the way it was done in the old days. The man in the front office will also find it valuable to study in familiarizing himself with the lithographic business as it appertains to the offset process.

WARREN C. BROWNE.

New York City,
1922.

TO keep informed upon the latest phases of lithography, read the NATIONAL LITHOGRAPHER, issued monthly. Subscription: United States, $3:00; Foreign, $4:00 per year. Published by the National Lithographer Publishing Co., Inc., Warren C. Browne, President, 150 Nassau St., New York City.

INDEX

PAGE
Forewords 4, 5
The Offset Process 9
The Offset Press 13
Preparing the Plates 21
Engraving on Metal Plates 45
Transferring on Metal Plates 57
Re-transferring 93
Re-transferring from Type 95
Proving 99
Alterations 101
Preserving the Plates 103
Offset Press Work 107
Dry Lithography 129
Photo-Lithography 131
Tin Plate Decorating 169
  Register Methods 177
  The Presses 181
  Rubber Blankets 186
Useful Information, Formulas, etc. 201
Advertising Section 211

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OFFSET LITHOGRAPHY

The Offset Process

SEVERAL years ago THE NATIONAL LITHOGRAPHER made the assertion that the offset press would revolutionize the lithographic trade and it was scoffed at by many old lithographers who contended that while it might be possible to do some kinds of commercial work by the rubber offset process, the idea of doing color work on an offset press was the height of folly.

It was pointed out that as the work had to be transferred to a metal plate and printed first on the rubber blanket and then to the paper, it was obviously impossible to do color-work on such a press. In the first place you could not carry color enough, then the register could never be made close enough for a color job, and then—well, all kinds of arguments were offered, and some of them sounded quite feasible, but finally first one press and then another got a trial at color work. One man put a color job on his offset press because he had no other press on which to work it—and he had to do the job. He was surprised at the quality of the work—as, also, were the other people who tried to do color work from their rubber blankets, but the work went right along and some very creditable jobs were turned out.

But the scoffers said that coated paper could never be worked on a rubber blanket press. Of course every lithographer knows that coated paper is an "effect" rather than a "cause." People use it for certain kinds of work because they cannot print the work on paper unless it is coated. With the offset press it is not necessary to have coated paper in order to get the right effect—the offset printing attends to that—but some people insisted on coated paper and the offset press seemed to take to that just as it took to everything else that was offered to it. But the scoffers "stood pat" on the half-tone. There was a condition under which the new process must fall down. No offset press could possibly carry ink enough to enable it to print a solid half-tone—that much was sure. The owner of an offset press put a half-tone down on a plate and started up the press. While it was a slow job to start the first time, the press not only printed it perfectly, but actually printed it on rough paper that the type press could not have worked to have saved the country from going to the dogs.

Those who have used the offset press have found that the cheapest material from which lithographing or printing can be done successfully is the metal plate. A plate of this kind large enough for a big offset press costs less than five dollars, all ready to receive the transfers. A stone of the same size would cost $100. Plates can be put aside and kept for years and then put on the press and run again. In the meantime they can be placed on a shelf or in any dry, clean closet without deteriorating.

For magazine printing this new process offers a money saving proposition that cannot well be allowed to pass by the publisher. In the first place the process admits of doing fine magazine work on paper about one-half the thickness and weight of that now universally in use on work of that kind, and at the same time gives the reader just as fine-looking work, and the advertiser all that he could conscientiously ask for. A net saving in paper of fifty per cent. and the same in postage is assured. When the plates are to be preserved, as is done by many publishers, the metal plate offers advantages that the electrotype never possessed. It takes up but a fraction of the space called for by the expensive electrotypes and will require practically no preliminary work in getting it ready for the press when a new edition is wanted, as the form is already made up and ready to run. No make-ready is required on an offset press.

The question of printing color lithography on an offset press has been before the lithographic public for some time—in fact, ever since the introduction of the offset process. There are now on the market several different makes of offset presses and all of them are capable of doing good color work. Some of them are printing in eight or more colors on sheets 44 x 64, and there are no heavy ones or light ones among them—the sheets are uniform. It is a fact known to those familiar with the offset press, that old, worn engravings can be made to show better work on the offset press than upon any other press on the market.

While it is true the offset press was originally intended for commercial work, it has gradually been working its way into the color field and has made good from the start. Some of the jobs of color work now on exhibition, made by the offset process, would be a credit to any process of reproduction extant, and demonstrate beyond any possible doubt that in the field of fine color work, the offset press is a contender.

Every day somebody discovers something new about the machine and the process that nobody dreamed of or believed a short time ago. Work has been produced on it that practically demonstrates that anything that can be lithographed at all can be done on an offset press. While one man makes a specialty of half-tone and type work, having acquired the knack of doing this kind of work a little better than anyone else can do it, another man discovers that maps and work of that kind can be done to better advantage on an offset press than in any other manner. Some people, on the other hand, have installed offset presses with the idea that once installed all that is necessary is to throw the copy at the press and the rest will be done automatically. This is a great mistake, for, while the offset press is undoubtedly revolutionizing the lithographic trade, it requires skill and attention to make it work successfully. The many beautiful samples of lithography turned out by the offset press demonstrate clearly what can be done on it and, despite the skeptical, the more we see of the product of the offset press, the more thoroughly we are convinced that it is the process of the future. All that is necessary is proper material to work with, a little experience and good, hard common sense, and it can be made to turn out beautiful sheets of a regular job.

The Offset Press

THE rubber blanket offset printing press has as its basis the substitution of metal plates for lithographic stones. Without metal plates the rubber blanket press would be practically impossible, and for that reason it is well to bear in mind the very important part that these plates play in modern lithography. After the plates have been prepared and the work transferred and rolled up, as described elsewhere, and it is gummed up and allowed to dry, it is then ready, after washing out, for printing.

The process of printing by the offset press is by no means a difficult one. In fact when it is carefully studied, one is surprised at the simplicity of the whole affair.

Three cylinders, one to carry the printing plate, another to carry the rubber blanket, and a third to carry the sheet and effect the impression from the rubber blanket to the paper, is all that is required. The fewer the additional parts, the better the press and the more easily it will be learned and understood. Of course there are a certain number of gears, shafts, rollers, etc., but primarily the press consists of three cylinders.

There are several features of offset lithography that assure its permanency as a lasting feature of the trade. In the first place the rapidity of the work and the fact that the output of the press can be handled almost immediately after it is printed gives it a place in lithography that has heretofore been vacant. The fact that rough paper can be handled, and a clear, clean and sharp impression secured without the punching through that is bound to occur where type or electrotype plates are used or the omissions of parts of the work where stone is used, makes this process of the utmost value to lithographic establishments. When you take into consideration the fact that a metal plate takes the place, does the work of stone costing many times as much, all danger of breakage is eliminated, and the plate can be stored in a fraction of the space required by the stone, there can be no question as to why everybody in the trade ought to be interested in the metal plate question.

When it is taken into consideration that the roughest as well as the hardest papers can now be made to take up the ink impression in perfect solidity and sharpness, and with the use of only about one-third the usual amount of ink on the work that would be necessary if printed direct from stone by the flatbed or on a direct rotary machine, then the vast importance of the offset method will be at once apparent. This power of securing a more solid and sharp impression with less volume of ink preserves the work on the plate, as it does not have to be fed with an overplus of ink to fill in the pores of the paper during impressions, as is the case when printing direct from the actual printing surface to paper, and, consequently, the trouble of filling-in, scumming, and thickening the work is virtually prevented by removing the chief cause. This means longer runs without deterioration of the work, and less trouble for the machine man in applying solutions and antidotes to both ink and dampening water, to say nothing of the economy effected in the amount of ink consumed. As either zinc or aluminum plates are employed as the printing surface, an additional economy is here effected over the use of stones.

So elastic and adaptive is this rubber offset impression method that such uneven surfaced papers as imitation alligator skin embossed papers are perfectly printed upon, even with such work as fine copperplate headings, and without destroying the indent markings of this peculiar paper—a feat unattainable by any other known process of printing. With such absorbent papers as common brown wrapping paper we have secured a perfectly flat and solid impression with the thinnest film of ink on the forms. There is absolutely no need for etching the work into high relief; in fact, this would be a drawback for this class of machine, as the rubber blanket would soon become indented and rendered uneven for succeeding work.

The sheets receive much less pressure than they would if printed directly by the old method, and as the rubber impresses the ink most delicately to the paper—similar to the fleshy pad of the human finger—there is less stretching and distortion of the paper during printing, less risk of creasing and overlapping and so much better register can be obtained for color work on plain papers.

But the merits of the offset machine are not alone confined to the improvements effected over the old form of work. For example, lithographers can now accomplish with photo-mechanical half-tone work what has hitherto baffled the typographers to attain, that is, they can print ordinary half-tone images on plain uncoated papers, free from the injurious gloss and glare of the highly glazed coated papers now in universal use for this work. Thin paper can be used as successfully as thicker paper, and thus both the weight and bulk of the printed sheets will be most materially reduced.

In printing half-tone work by the rubber lithographic principle, we get a pure solid dot impression, not, as with the typographic process, the raised point of the half-tone forced partially into the glazed paper surface, so that the center of the dot becomes denuded of its ink, as this has, during the act of impress, become squeezed out around the outer edge, in the form of a very obtruding penumbra. This drawback is eliminated by the offset method, and if use is made of the high light and sensitive process method, we have the most perfect half-tone printing methods extant.

When the first steam or power press was introduced in this country about fifty years ago, like most new inventions, it was greeted with the utmost contempt and condemnation by the lithographers who failed to see anything good in the new order of things. However, the steam press has been used ever since and it was the making of the lithographic business in a commercial way. Then press manufacturers began to experiment with the steam press and from that came the metal rotary press. The French claim that as their invention, while an American manufacturer avers he was the inventor—however, it came, and added improvements have given us the rubber-blanket offset press, which gives us the premier position in modern lithography. With this process it is possible to make a transfer on metal in much less time than it takes to transfer to stone, put the plate on the press in less time, and instead of printing 1200 impressions an hour, or 7000 a day, several hundred establishments are printing more than 4000 an hour and the work covers every phase of lithography.

The progress in reaching the present stage of efficiency is very interesting. With the introduction of metal plates the wise printers were not content to work in the old way on flat-bed presses with their small output, and those engineers of an inventive turn of mind directed their attention to the construction of rotary machines on which the plates could be used. When it had been demonstrated that the rotary press was a thoroughly practical machine, the builders decided to go a step farther and try a press that would print two colors at one time—a two-color rotary. Never had it been commercially practical in lithography to print two colors from stone in one run through the old flat-bed press, although two-color flat-beds have been made.

Inventors, lithographers, and press builders have striven for years to perfect a machine which would allow them to put on the various colors of a picture in one run through a press. It was found that perfect register was obtainable in a rotary press, and from the form of construction of the machine it was possible to put in a third cylinder and an additional set of rollers, and put two colors on the sheet of white paper before it had passed through the press. Great as this improvement was in surface printing machinery, it was but a step to a three-color press, with the effects which are obtainable with the combination of three colors. Then still further improvements were made until now we have the rubber offset which can do multi-color work with startling rapidity and effectiveness.

The rubber blanket, while not new in its application to printing, was formerly confined to tin printing, and its introduction to commercial lithographing dates back but a few years. It was found that an impression, because of the elasticity of the blanket, could be had which would bring up every line in the engraving, no matter how fine it was. No matter how fast the press ran the work came out just the same. It was soon seen that the rubber blanket would print on a sheet of dry bond paper, as well as a stone press printed on a sheet of "super" or on a damp sheet of bond, and the very nature of the impression showed that if the ink rollers were working, everything on the engraving must come out and come out clear. That settled the question of the practicability of the offset press for commercial work. It was agreed that a press that would turn out 4,000 sheets an hour and run along like a sewing machine, printing on dry bond paper, and bring out every line perfectly, had passed the experimental stage.

But to get right down to the way metal plates are handled after they have passed through the transferring process, which is the object of this chapter: The several manufacturers of the offset press construct their machines differently, of course, but, as said before, they are in the main similar. There are three cylinders, although each machine possesses its variations and peculiar distinguishing features. The top cylinder in all of them is, however, the bed, or plate cylinder. Around this the metal plate is clamped for printing. The middle cylinder is the rubber or offset cylinder, while the bottom one is the regular tympan or printing cylinder. The inking arrangements for the printing plate are not unlike those on a web press, but the inking rollers provide a greater distribution than on any other machine made. In connection with the plate cylinder is a water fountain and a set of water rollers made especially for the offset press. The water rollers are locked down upon the plate cylinder before the inking rollers, and the machine is ready for business. The whole surface of the plate is damped except the transfer parts or the substances to be printed, and of course the water does not act upon the greasy parts in any way. Now the ink rollers, passing over the plate will deposit no ink where the plate is damped, but they ink the transfers to the required strength. The inked up transfers print on the rubber cylinder, the sheets fed into the tympan cylinder receive their impressions from the rubber blanket, and the work is done.

The metal plates used are nearly as thin as fine paper and the cut-off on the plate cylinders is only about one-sixth as deep as the cut-off on most of the flat-bed cylinders. When you look for the bearers on the offset press you have to feel for them. Anything like so shallow a cylinder on the old-fashioned press would wear out the printing material in no time. It is right here, if nowhere else, that the offset press has achieved a triumph which will afford press manufacturers something to think about for some time to come. It has greatly reduced the terror of that awful word "wear." The plates used are granted lasting qualities for the reason that the pressure exerted upon them is very slight. It prints upon a rubber blanket. A man can press his thumb upon it and make a deeper indentation than takes place at each impression. This relieves the mechanism of all strain, and leaves the cylinders free to travel in absolute unison, which has heretofore been impossible. It makes no diffrence to the offset whether it is turning out a heavy printing or a light one, the resistance in one case is not materially different from the other. Rigidity of construction, it may be said, has been placed almost secondary to accuracy of contour, and in this last the builders have reached a degree of perfection never before realized. The variation in the printing surfaces of the cylinders are so light that, were it mentioned by the fractional part of an inch, the expression of the fraction would consume a whole line in this book.

An offset press does not have the appearance of running at such terrific speed when you stand alongside it, but when you get in front of one you see the sheets falling like so much confetti on election night. The absence of static electricity in the paper is remarkable and proves that it has always before been the result of friction. The sheets shoot out one after another in the manner that grain comes from a threshing machine.

Preparing the Plates

THE substitution of the metal plate for stone is now such an important factor in lithography that the lithographer who is progressive and wishes to consider himself thoroughly efficient must possess a fairly comprehensive and practical knowledge of its manipulation and possibilities.

Every up-to-date lithographer knows that since the introduction of lithography, more than a hundred years ago, much time has been spent and many experiments have been made by those interested in the art to discover an efficient substitute for the Solnhofen stones. The great Senefelder himself was the first to look about for a less cumbersome material to work with, and this research has been continued up to the present time.

There have been many setbacks and disappointments, but by a system of elimination, after a century devoted to experimenting, the present day metal plate has been evolved, and there is no question about its permanency as a factor in lithography.

During the past century there have been many so-called perfect substitutes for the lithographic stones, and we have witnessed the failure of most of these new printing surfaces. These failures, however, have only spurred lithographic inventors to greater activity, and within the last few years great headway has been made in the effort to devise a method to supersede stone.

In this process of substitution we have heard a great deal about the qualities of zinc and aluminum plates, and we have seen a great amount of good work obtained from both. Rapid strides have been made in the manufacture, preparation and method of working these metal plates, so that we now have a printing surface which is equal to the best Bavarian stones, and that fact is becoming more apparent every day.

Although metal plates of one kind or another have been in the market for a great many years, there have been periods when they fell into disuse, one of the most objectionable features in the past being their dark color, preventing the eye from distinguishing clearly the sharpness of the work. Chemical science tried many methods of coating, depositing, and crystallizing matter upon the surface of a plate in order to obtain a suitable printing surface, and latterly a plan to render the face of a plate more porous than ever before was evolved. The cheapness of zinc led chemists to inject into the outer surface of zinc plates a certain crystalline deposit which, in penetrating the outer crust of the metal, left a white covering as a fixed part of the plate, which equals the brightness of aluminum. This treatment, it was found, prevented the usual oxidation; it opened up the porosity of the zinc, to enable the transferred lines to enter deeper into its surface, and thus hold the work firmer. This increased porosity, at the same time, holds the moisture longer in the damping process, and altogether it has filled a long felt void in lithography.

Still, many lithographers have held to aluminum despite the difference in the cost; the bright, silvery color of its surface appealing strongly to them; this is especially true in England, where the advent of aluminum was hailed with delight by so many in the trade, and where they are slow to take up new processes.

If the inexperienced lithographer is wise and wants to save himself time, trouble and money, he will start in by procuring his plates from some dealer who makes a specialty of preparing them. There are some, however, who prefer purchasing the non-processed plates and graining them to suit their own particular ways; but for the man who is just beginning metal plate printing, the most inexpensive way is to procure prepared plates, thereby obviating the trouble and cost of machinery and the possibility of errors which will be costly and very discouraging.

There have lately been put on the market for sale several kinds of metal plates, both prepared and unprepared, each claiming a superiority over the other. While it is not the province of the author of this book to advance the cause of any particular process, the assertion is ventured that a carefully prepared metal plate is far preferable to the raw plate, for reasons which will be set forth in detail later, and the statement is vouchsafed that metal plate printing has come to stay. Under this process the chemicals used in preparation are incorporated with the metal, so that transfers are put down not on any artificial surface, but on the metal itself. Directions for handling unprepared metal are also included in this work.

Information and directions given by various experts for transferring, preparing and printing are incorporated in this book and, if they are closely perused, they will be found to be simple and valuable. Those who are in the trade ought to take every opportunity of studying this subject deeply and testing carefully the various plates which are available for printing purposes, always keeping in mind that the father of lithography was not satisfied with the parent method and spent much time in searching for a suitable substitute for stone.

The prejudice which has hitherto checked the progress of this branch of lithography was not altogether of an unreasonable character, in view of the fact that until recently the plates themselves were far from reliable and the difficulties resulting from them were a fruitful source of trouble and expense. Practical lithographers were wont to look askance at every new device presented, and the many failures encountered caused them to adhere with determined loyalty to the original method, and cast aside as unworthy any and all substitutes.

Time has made many changes, however, and, while metal as a printing surface, is even yet a comparatively new factor in lithography, beautiful results have been given us by that medium, and it behooves every lithographer to make a close study of the newer process in metal plate printing.

Just as the human race has passed through its rude and crude stone age of the dim and distant past, on to the present vitalizing metallic epoch of mankind, so likewise has the craft of lithography traversed through its cumbrous quarry period of the unwieldly litho stone and wooden press, on to that of the modern, mighty, power-driven rotary and offset press of to-day, their printing surfaces of metal plates fast usurping the old-time stones.

It is no secret that zinc was the pioneer metal that ventured earliest into the competing field of the lithograph slab, and that it has at last securely established its vast importance in present-day lithography. All this serves to prove that class will ultimately triumph, even though it has had to pass through many exasperating vicissitudes and checkered experiences in its transit to the coveted goal; yet, that it has arrived to stay is being universally recognized and accepted.

The majority of litho printers have been working with the litho stone from their apprenticeship till the present day, and it is not surprising that in relation to the use of stone almost every possible contingency has been provided for, while with metal plates a little fresh knowledge must necessarily be acquired before the workman can claim the same familiarity of manipulation which he may feel toward the parent process. This is, in fact, the point upon which the whole question usually turns. Good work can be produced from metal plates—of that there is not the slightest doubt—and it is equally certain that the advantages offered by their use are of a substantial and practical character. They can, in the first place, be handled with ease, and then again there is absolutely no fear of breaking them. In addition they are less expensive than stone and require less storage room.

A grain of a finer and sharper texture can be imparted to the metal than is the case with stone, and what is even of greater importance, the character of such a grain remains unaffected for a considerable time. Surface inequalities are rarely encountered in metal printing surfaces and consequently uniform pressure is to a certain extent guaranteed.

Although an unprepared metal plate, which has been carefully polished to free it from every trace of grease, can be used for lithographic printing, excellent results are obtained from the plates which have been specially prepared, and in many houses they are preferred to the plain plates. Many of these prepared plates are so satisfactory that half-million runs have been made off one plate without deterioration, the last impression being equal to the first. Any lithographic printer of ordinary intelligence, can, by following simple instructions, do any class of work successfully from a metal plate on an offset press.

As these processed plates do not oxidize either from water or ink, and are all ready, without treatment, for the artist or transferrer, it is needless to dilate upon them further.

As there are a few houses who prefer purchasing plain plates and treating them themselves, some methods dealing with this treatment are here given.

While the art of drawing on and printing from metal plates in a lithographic manner is by no means new, yet, as the percentage of lithographers having had some trouble in the manipulation of this printing surface is large, we shall give some information appertaining to each section of the art, trusting that our text will prove of value to all those interested in lithography.

Of the many makes of metal plates on the market, each possesses distinct advantages for special lines of work. Some have a chemically prepared surface, others have a mechanically prepared surface, while a few are prepared electrolytically.

A slight de-polishing with pumice sand and a piece of felt may impart the requisite "tooth" to the face of the unprepared plate, or it may be cleaned with the pumice sand and felt and then immersed in a hot bath containing 36 ounces of water, ½ ounce of alum, and 2 drams of nitric acid. This liquid should be kept in constant motion over the face of the plate until it assumes an even, silvery gray appearance, and then the plate should be washed thoroughly with a plentiful supply of clean water. It should then be dried quickly.

The plates are of various and numerous kinds, having either a grained or a smooth surface, and are made in several gauges. The stock gauges are usually 25, 22, and 19, BWG, but other gauges can, of course, be made to meet all requirements.

For general work on the transfer press, it is customary to have a fine grained surface, and plates for rotary, flat-bed or offset machines must be a little coarser, so that they may be the better enabled to hold the moisture.

In Europe they have adopted what they call the "Continental Graining" method for treating metal plates and the larger lithographic firms in England have put it into use. This consists of a large-sized plate-graining machine fitted with a very deep box recess into which is arranged a number of smaller graining boxes of a much shallower description, being just deep enough to allow each box to carry a plate and the graining marbles, with just enough margin to spare for working purposes.

These smaller boxes are wedged in tight in tiers in the large box, one above the other, a dozen being worked at the same time, so that in the running of one plate-graining machine, as many as a dozen plates are being prepared at one and the same time; an important consideration where a number of small litho machines, engaged on short runs, have to be kept going.

After the graining of the plates is properly completed, they are well washed back and front, to remove any adhering pumice paste or grains of the powder; they are then treated to an "alum acid bath," which renders them much more sensitive to grease, and also insures their being made chemically clean.

This treatment is known as the "affinitizing bath," because the function performed by it is to cause the plate to have a greater affinity, or susceptibility, to the greasy ink, after having been subjected to its influence in this bathing process.

To carry this operation out economically on a large scale, a huge upright glazed earthenware tank is employed, fitted with overhanging supports, from which the various plates may be suspended in the bath; or they may be inserted in niched grooves, which are also a separate feature of this bath.

This bathing is done on a smaller scale by means of horizontal porcelain dishes; or in a more economical manner still by means of wooden troughs, pitch lined, or coated with acid-proof resist varnish, such as asphaltum, or a mixture of shellac and varnish. The constituents of this affinitizing bath as used are:

Nitric acid	6 fluid ounces
Powdered alum	½ pound
Water	1 gallon

The alum is best dissolved in warm water, as it is so slowly soluble in cold water.

The plate is immersed in this bath for a period of about 5 minutes. When it is first inserted in this solution, a dark gray deposit quickly forms on its surface; this is sponged off so as to enable the liquor of the bath to again obtain full access to the plate, when eventually it will assume a pleasing silver gray hue, which is both a nice color to work upon, and a true indication of the best condition which the plate should attain to fit it for the best service in lithography.

Many establishments, both at home and abroad, in using the plates that are not prepared, obtain a fine matt surface by graining the plate either by hand or with a graining machine, securing a medium or coarse deep grain which can hardly be seen by the naked eye.

The principle involved in the graining is the use of a very fine powder, harder than metal, moved crosswise under a certain pressure which is produced by a weight. The surface is thus given scratches which differ in length, depth and number. The breadth and depth of these scratches depends upon the hardness of the graining material, the amount of pressure, the shape and size of the graining particles, and on the shape of substances used to produce the pressure. For machine graining the materials used are: First, the finest pumice powder which is the softest graining material; second, yellow sand as for stones, or flint sand numbers 2 and 4 of medium powder; third, emery in No. 000 and 0, which are very hard and grain well; and fourth, grit, which is the hardest and gives a coarse grain.

The weighing materials may be marbles of either wood, glass, steel or earthenware, the diameter of which should be from ½ in. to 3 in., or ordinary pebbles, which can easily be obtained from any river bed. These should not exceed 1 to 2 inches.

In order to communicate the rubbing motion to the graining material a graining machine is used consisting of a strong water-tight tray which rests on ball bearings, which is set shaking by an eccentric. The shaking motion causes a movement of the graining and weighing materials. For smaller sized plates wooden frames are sometimes used.

When the graining is finished the plate must be removed carefully—and this is an important point, as if not properly carried out the surface will be scratched. While the machine is moving the weighing materials should be brushed away from one corner, and this firmly grasped by the hand and the plate slowly but evenly pulled out. It should be then well washed in running water, and dried as quickly as possible before a fire or with an electric fan.

To grain by hand the plate should be fastened to a flat board, a sufficient quantity of coarse sifted sand, with some water sprinkled over it, and a plain iron weight used, or a litho stone. Small circular strokes should be used for about fifteen or twenty minutes. It must then be washed, covered with a fine sand of 120 to 150 mesh, plenty of water used, and a bundle of No. 3 steel wire used for graining. After about ten to twenty minutes, when the surface should show a matt white surface of regular grain, the plate should be again washed and dried with a clean cloth.

After the drawing is laid down on the plate the following etching solution is recommended: One part of ammonium silico-flueride, one part ammonium nitrate, dissolved in gum water; this should be allowed to act for about two minutes. Instead of the above a mixture of one part ammonium biphosphate, one part ammonium nitrate, in gum water, may be used. These give a firm, homogenous surface, which is completely insoluble in water. Corrections can, however, be made with dilute hydrochloric acid.

Until recently the lithographic craft did not seem to contemplate the possibility of enlisting revolutionary methods of etching treatment as now evolved, wherein electrical action as well as chemical ones are generated in the so-called etching operations, which afford the most perfect results. Then the plate would oxidize as readily after the etching operation as before it. Now that trouble has been almost entirely eliminated.

In order to better comprehend and apportion the relative conditions that prevail in these methods of modern lithography, we must first briefly allude to the underlying principles that dominate lithographic printing from stone; which will afford us the co-relative cue for the metal.

On stone we speedily recognize that two entirely different physical and chemical conditions have to be attained, and undisturbedly maintained on its surface, during the actual printing operations. The one is a fatty compound, produced and preserved by means of the grease-laden ink of the design; here the fatty acids contained in the transfer inks, possessing a chemical affinity for the lime base, of which the stone is comprised, form with it a grease-attracting and grease-retaining allegiance, and consquently a water-resisting one.

We have now to account for the other remaining plain portions of the stone surface; these also need definite chemical treatment; in this case with a free acid (nitric solution), which decomposes them, producing at the same time physical changes; first by making these plain places of a "rough," "matt" and "granular" character; which condition not only serves the purposes of miniature reservoirs for the retention of the essential damping water, but also affords a "grip-hold" for the inking rollers, when passing over the stone; and this more effectually prevents them from skidding and sliding over the face of the work.

At the same time, the decomposition of these parts by the acid solution, has had the effect of raising the work slightly into relief.

But this is not all, as we have not yet obtained the full requisite chemical conditions, indispensable for these plain parts to acquire. This can only be done by what is known as the "gumming operation," in which we apply to them a syrup solution of gum arabic, this on its drying and oxidizing with these uninked portions of the stone, forms there that important and necessary compound known as 'gummate of calcium," a compound entirely different in character and condition to that possessed by the fatty calcium compound; being in fact the direct antithesis to it, and none the less ignorable.

Here, then, in the lithographic stone as a printing medium, we have a natural substance, upon which we can produce two contrary conditions: one whose natural attributes are an affinity or liking for water (which is supplied in the damping operations), and which affords those portions the power to reject grease; in the other we can create a grease attracting and water rejecting condition; both of these peculiar qualities being absolutely essential to planographic, or flat surface printing, as represented by the lithographic process.

If either of these two adverse conditions should be faulty, then perfect printing cannot be effected; as for example, assuming that the image has been perfectly drawn upon the stone, if the "lights" become soiled through an inefficient gummate, then the actual print itself becomes degraded.

Equally so then are the same resultant conditions vital in the metal printing process, or flat surface printing in the lithographic manner from zinc or aluminum plates.

Commencing first with zinc: here we find that this metal also possesses (like the litho stone) a strong affinity for fatty bodies; hence greasy transfer inks combine readily with it. In fact, it is even more sensitive and susceptible to grease than the stone, so far as superficial relations are involved; but at the same time it does not inherit similar internal penetrative facilities as does the stone, on account of the difference existing in their respective parasites; specific gravities, and molecular structure; the stone, moreover, being a compound body while the zinc is a simple elemental one.

Yet as we have before intimated, we endeavor to compensate for this in some degree, by applying a supplementary greasy body in a fluid form, in which state it is capable of a more piercing and penetrative action; so that in the end our grease compound on the zinc plate becomes as stably formed as the similar corresponding compound is established upon the stone, notwithstanding the difference in density that prevails in these two bodies.

This is one of the factors that has made for the modern triumph of zinc.

But equally important, and which long has proved to be the most difficult to attain on zinc, is the opposing state, that of the aqueous bearing portions, or gummate of the metal; where it is essential that those parts shall be "de-sensitized" to grease, so as to form and preserve the perfect lights of the image.

Instead of merely eating those parts slightly away by the agency of a corrosive acid, and leaving soluble compounds behind, as in the case of the old etching operations, we now, in the latest and most perfect methods, apply a solution, consisting of a mixture of various chemical compounds, which generate with the metal itself a voltaic action, which in, and through, this electrical influence, produces a new surface compound or layer, in direct chemical union with the zinc itself.

This new surface is the most perfect grease-resisting medium yet devised or secured from a metal surface.

In short the whole of the plain zinc surface that has come in contact with this fluid has now become transferred from the simple metallic elemental state in which it originally existed, into that of a new compound body, possessing entirely different physical and chemical attributes, inasmuch as these parts of the zinc surface have now a predominant affinity and preference for water, and an absolute inability to hold grease when moisture is present and applied to them, in contradistinction to that state in which, immediately prior to this treatment, they had absolute preference and susceptibility for. All this remarkable change being accomplished without any loss in the volume of the metal, even so the so-called etching operation should have been prolonged inordinately.

Whereas, in the old-time method, when zinc was struggling for a place in lithography, a prolonged etching spelled ruin to the finer parts of the work, such as hair lines and delicate stipple, owing to the undercutting action of the acid creeping under the lines, and thus undermining the fine work.

It may further be affirmed that with the most perfect etching method, a more prolonged treatment with the etcher is often of an advantageous nature, especially when an excessively greasy quality and brand of ink is being used, as is sometimes the case; here the extra etching operation appears to carry the grease-resistive properties to a lower strata of the metal, and thus render it much longer immune to grease encroachments, if the natural attrition of the plate during the work should have thus impaired its original upper surface layer.

This, taken in conjunction with the greater speed of the rubber offset presses, has advanced the cause for metal as a printing surface in lithography, not only to a par with the old-time stone, but far beyond it for productivity, security, economy and efficiency.

Aside from the proprietary processes protected by patents, it will no doubt prove of great interest to describe a few European methods for printing, lithographically, from metal, both zinc and aluminum.

Commencing with new, plain uncoated sheets of zinc, of the purest quality, plates of a thickness registering from 19 to 22 (British wire gauge) are selected for machine use, both flat-bed and rotary. These thicknesses of plate enable them to be bedded down to their supports perfectly taut and without buckling.

For the hand press, and for originals, thinner plates than these are employed, usually ones ranging from 29 to 25 BWG, are the gauge sizes usually used.

Zinc plates are ordinarily procured through the regular supply houses, and are then generally bought surface-grained, ready for immediate use. There are some firms, however, who obtain them in the bare, unprepared state as sent out from the mill, with the hard, scaly, outer skin of the metal still adhering to them, as produced in the rigid rolling operations of manufacture. In this case additional tasks are imposed upon the lithographer, who has to first see to the removal of this outer skin, and to selecting the best face of the plate for the printing surface proper.

It has been found from experience, that one face of the plate is purer and freer from defects than the other. This is due in large measure to tiny specks of iron being taken up during the heated manufacturing process, in which, due to the specific gravity of these two metals being different, the zinc, being the heaviest, will fall to the bottom, while the lighter metal will remain on top.

If, therefore, the new plate is first tested on both sides, the best face is easily detected, and at once reserved for the printing surface. This is done by mixing one part of commercial nitric acid with ten parts of water, and then applying some of this over a part of each face of the plate, either by means of a sponge or a pad of cotton wool.

If as a result of this treatment one side reveals a number of small, black specks and streaks, or dark circle markings, this will be the inferior side of the plate, and should be destined to always form the under side for working; the other side of course, being the one selected for the actual printing surface.

This chosen surface is then lightly polished over with a flat, smooth block of "Snake Stone" (water of Ayr stone), in order to remove any dross or shell.

Then next the extreme clamp edges of the plate, both "gripper" and "rear," are bent right over in a lap to the extent of about a quarter of an inch, so as to form a thicker wedge-like edge, which serves as an additional grip-hold for the clamps on the plate when backing-up, and which is consequently a double security against them slipping, or "dragging out," during both tightening up and printing operations.

The correct bend of the ripper edges of the plate is next made, some establishments using a special "vise mould" for this purpose, while others simply fix one of the plate edges in the grip-bars of a plate bed, and then by means of a long, smooth batten of wood, laid in contact with this edge of the plate which is then struck a smart blow with a wooden mallet, at the same time as the zinc plate is being bent down bodily to the plate bed.

This plate-grip bend when once formed, need never be straightened out again, if proper provision is made for its protection, as the repeated bending and re-straightening of this defect soon causes the metal in this part to crack and break away, which then necessitates the plate being cut down for a smaller size.

Some few old-fashioned firms, however, may still be found, who adhere to this injurious practice of re-bending the grip-edges of the plate each time they have to re-grain and re-transfer upon them for fresh jobs.

The general run of firms, however, provide bevel-edged wood supports in the bed of the graining machine, and also bevel-edged iron plates for the transferring presses; so that once the plate is bent at the clamp edges to suit either the flatbed machine or the rotary there is no need to resort to the re-straightening, or flattening out process again each time a plate is reused for a fresh job, as everything is adapted to suit the requirements of the clamp curve during all the necessary phases of manipulation, contingent upon the preparation of a plate.

Now, as to the graining of the plate, lithographers using metal soon learn the exceeding importance of this branch of the business, as, if a plate is grained too feebly, then it has not the capacity to retain much moisture upon the surface, and consequently will sooner soil with the printing ink; this condition also necessitates a larger volume of damping water being applied to maintain the purity of the lights; this naturally reacts upon the brilliance of the ink, dulling it and overloading it with moisture, which reflects itself in the grayness of the print. On the other hand, the transferrer favors a fine, delicate grain, because it is easier to roll up the work, as well as to run it down firm and solid, than if the grain of the plate was more "rasping" and "keen."

This perversity of conditions frequently prompts a slight clashing of interests between the transferring end of the business, and the press room end.

The pressman unhesitatingly urges the more decided graining of the plate, so that the tiny excavations of the grain will form a more perfect reservoir for the retention of the damping water during printing. While the transferrer is partial to the more delicate graining of the plate, so that the fine lines of his transfer and his solids will be brought under more uniform and accommodating conditions; thus enabling him to send forward an irreproachable transfer with expedition.

The most common graining material in use in America is a medium texture pumice powder. This serves for the general run of work. For producing a coarser grain for poster work, flint sand and coarse glass powder are both used. While emery powder, fine glass powder and carborundum powder are each employed for other range and classes of work.

For map printing, the plates are sometimes grained with the sand blast, in which fine hard sand is used for the graining.

Hitherto wooden balls were generally employed with the graining machines, but now they are being rapidly displaced by the porcelain balls, which are heavier, cheaper and wear better; not being so prone to form flat sides on them, as is the custom with the maplewood marbles. Glass marbles are also extensively used.

Another good feature in connection with them is, that they do not adhere together in small clusters, as the wooden balls do when flats have been worn upon them, as the porcelain marbles wear down in a rotund manner, instead of angular, which is the drawback with the wooden marbles.

The English have a method of graining the plate with dry powder only, using no water whatever, during graining operations. This plan, however, takes a little longer time to attain the desired granular matt effect of the plate surface, yet the grain so attained is preferred by some.

Whichever method is adopted, the grain can be slightly subdued, if the transferrer in his judgment considers it too crisp; this is done by going all over the plate with a felt-covered block and some finer pumice powder, by supplementary hand method for two or three minutes, but to leave the grain as produced by the machine is preferred by most well established houses, although some transferrers consider the plate is not complete till it receives this finishing touch by hand.

In the purchasing of non-processed plates, it is often advised to obtain the largest sizes, and cut the sheets down to suit the work in hand. To prevent the plates from being bent or cockled, great care should be exercised in cutting them down. They must be kept perfectly flat, as any unevenness of surface is sure to interfere with their successful working.

There are several very good methods of shortening, or cutting down, the plates. An ordinary book-binder's card-cutting machine is very useful for this purpose, as it allows the plate to lie perfectly flat and be held securely. If this cannot be obtained, or is not preferred, a fine, well sharpened saw will answer the purpose. After the plate is cut the burr must be removed from the edges with a file and the corners can be snipped or rounded off. When a new batch of plates is delivered, they should first be submitted to a thorough examination before putting into use. If this examination is properly carried out, much time and trouble will be saved in the future.

The plates, when delivered to the lithographer, generally have a perfectly even surface of a dull, silvery color, and are free from all marks and blemishes. A serious obstacle to perfect work is the presence of oxide on some of the metal plates. This sometimes appears on the surface of the plates in the form of white powder, and which can be detected by rubbing the plate with cloth. When plates are discovered to have an excess of oxide on the surface, or when they are stained, they should be returned immediately to the manufacturer as defective.

After the plates have been selected for use, those not immediately required are usually wrapped carefully in clean paper and stored in a dry closet or the vault of a safe, or some similar receptacle.

There is an excellent method adopted by some establishments upon receipt of new plates which is worth mentioning. Immediately upon their arrival, they are unpacked to prevent oxidation owing to changes in the temperature. They are then laid out singly and, when they have assumed the temperature of the room, the prepared side of the plate is rubbed over with French chalk, and each plate is then wrapped, carefully and separately, in clean, dry paper, and laid away in a dry place until required for use.

By this same method, when the time arrives for the design to be made upon the plate, the prepared side is wiped with a wet cloth to remove the French chalk, and then dried with a clean cloth that has been charged with a small quantity of oil of turpentine; the prepared surface is briskly rubbed to remove all traces of grease and finger-marks. It is again rubbed with another cloth charged with a small quantity of benzine.

This cleaning is followed by laying the plate face upwards in a large shallow earthenware dish, such as used by photographers, and flowing over it a solution consisting of one quart of either rain or distilled water, to one pound of citric acid of pure crystals. The bath must be kept in motion, and the surface of the plate must be rubbed frequently with a pad of raw cotton, by which means the dissolved metal and impurities are removed. After remaining in this solution for three or four minutes, the plate should present a dull, even surface, but if stains appear it must again be bathed in the acid solution until they have been removed.

When the plate has been treated in this manner to the satisfaction of the printer, it is thoroughly washed with clean water and rubbed with a cloth to remove any trace of acid that may remain. In following this formula it is well to give the plate a final rinse with water and dry it rapidly to prevent further oxidizing. The plate is then clean, and in condition for the artist or printer.

The foregoing may seem to be a somewhat elaborate method of cleansing, but it is a simple process if systematically carried out, and is sure to repay the extra time spent upon it. The trouble caused by greasy patches, which sometimes make their appearance when rolling up a plate, is entirely removed when this preliminary cleaning is carried through. Likewise the difficulty occasionally experienced in endeavoring to make a design hold firmly to a plate that has had a slightly oxidized surface, is entirely avoided. The trouble caused by oxide is of frequent occurrence in the workshop, and one that is not sufficiently understood by the members of the craft. If it were, the quality of the impressions obtained would be improved.

An important point is to have clean materials to work with. The various cloths and sponges used should be periodically washed in boiling water, and when not in use should be kept separate for their various special uses. In every branch of lithography it is essential to have clean surroundings, but nowhere do we find it more so than in the manipulation of metal plates; in fact, the secret of the whole process seems to be wrapped up in the one word—Cleanliness.

There has been several so-called "electro-chemical" processes of graining plates discovered or invented since metal plates have been successfully substituted for stone for lithographing purposes. Great claims are being made for them. One being that the time actually consumed in preparing and graining a plate is about one-fifth of that taken by the old process. Another claim made by a recent electro-chemical process man is that his process deposits as much metal on the plate as is taken off in the graining, so that re-graining a plate does not make it any thinner, and that it my be regrained hundreds of times without deterioration. This, however, is merely a claim.

Engraving on Metal Plates

THE art of drawing upon metal differs but little from the method of working upon stone, and it is only necessary to make a few general remarks upon this important branch of lithography.

After the metal plate has been prepared and passed into the artists' department, the first duty of the artist upon receipt of the plate is to examine it carefully to test its suitability for the work in hand. If any blemishes are present, the artist should have them eliminated. He should be careful at all times in handling the plates, and so avoid the trouble caused by the rolling up of finger marks. Thoroughly clean plates are very sensitive and consequently should be handled with the greatest care. An excellent plan, in use by some artists, is to obtain a sheet of paper the exact size of the plate; a rough outline is made of the size of the work to be drawn. This is then cut away, and the remainder of the sheet is gummed onto the face of the metal. When in position, the outer margins of the plate, that are not to receive the work, are fully protected, and the plate can be handled with much freedom, so that it amply repays for the little time spent upon it in making and fixing the mask.

The next thing to consider is the most suitable surface to lay the plate upon. Perhaps the most convenient and suitable table for the artist to use is an ordinary lithographic stone. One that is slightly roughened will be best, as it will prevent the plate from slipping about while being drawn upon. Another advantage to be gained from using a stone is that in cold weather the stone can be occasionally warmed, which will assist the flow of ink and make the crayon work more freely than it otherwise would.

The ink used should be a little stronger than for stone work. All solids should be filled in as full as possible, and should present a good black appearance.

If the plate is a grained one, the outlines and solid parts of the design should first be filled in, which will give a better idea of the amount of tone required. Care should be taken that the gumming-out solution is not applied too thickly to those parts nearest to the rubbed-in tints: the reason is obvious.

We may here mention that, should the artist have had no previous experience with metal, it would be advisable to obtain a small grained plate and try the effect of his various chalks before proceeding with the work in hand. In this manner he will become familiar with the varieties of grain obtained, as well as the power of the materials he is in the habit of using.

For chalk drawings it is advisable to use the harder crayons instead of the soft. The latter should only be used on the heavy parts of the design.

Scoring and scraping of the plate should be entirely avoided, because such lines or scratches are left with a burr on their edges, which take the ink and gradually fill in as the printing is proceeded with.

When the drawing is completed to the satisfaction of the artist, it must be thoroughly dusted with French chalk, well rubbed in, and the work is ready for etching.

The important operation of etching an original drawing is one that is best executed by the artist who produced it. He has the best knowledge of the quality of the work upon the plate, and understands which parts should receive the weaker and which the stronger etching. He also avoids the possibility of the design becoming injured by a workman who may have scant knowledge of the work in hand.

The acid solution to be used for this purpose is somewhat different from that for the stone. A good solution consists of:

Nut-gall solution	10 ozs.
Gum arabic solution (thickness of cream)	20 ozs.
Phosphoric acid	¼ oz.
Nitric acid	½ oz.

The strength of this acid should be altered to suit the work on the plate. If the design consists of many fine lines and stipples, add more gum solution. If it is required stronger, add phosphoric acid. The nut-gall solution can be made in the following manner: Three ounces of nut-galls are steeped in one quart of water for twenty-four hours. They are then boiled until soft, when they are crushed and strained through a piece of muslin. A few drops of carbolic acid should be added to prevent the formation of mold.

The etching of the design is accomplished as follows: Lay the plate upon a sheet of clean paper a few inches larger than the plate. Pour a quantity of the etching solution into a flat dish, take a broad camel-hair etching brush, and dip into the solution and coat the plate evenly. First cover the plate evenly, moving the brush from left to right, and then from top to bottom. When this has been properly accomplished, the plate should have an even covering of gum and acid upon its surface. It can be more evenly distributed by rubbing with the open hand, which entirely removes any streaks that sometimes occur when a brush is used.

Another method of etching that is recommended for high-class work is to place the plate in a flat, shallow dish and allow the etching solution to flow over its surface. By this means the danger is entirely avoided of injuring the drawing by the mechanical application of etching solution. When, in the opinion of the artist, the plate has been sufficiently etched, it must be stood up on edge and allowed to dry. The drying can be assisted by fanning the surface, but heat must not be used, or complications are likely to arise owing to the ink spreading or the gum drying too hard.

When the etching solution has thoroughly dried, the plate is in a fit condition to be handed over to the transferrer for rolling and proving.

It is well to repeat that almost every description of lithography can be executed from metal plates. The quality of the work obtained depends not so much upon the quality of the metal used as upon the care of the artist and printer through whose hands it passes.

Before going into further details of the metal plate process, it might be well to again point out to the lithographers who wish to be up to the times, the chief advantage to be derived from having a knowledge of this system. The fact that there is money in it is at once apparent, and, as experience of lithographic management has proved, the versatile craftsman knows his value in the workshop, while on the other hand, we have yet to find the employer who is not ready to appreciate, in a substantial manner, the superior all-around skill and knowledge of any workman who may be in his service. It is, therefore, of the utmost importance to all lithographers who have the interest of their trade at heart to study carefully the several methods and many little wrinkles for successfully working metal plates set forth in this volume.

In Germany, where unprepared metal plates are used to a large extent, the plate is first cleaned with saltpetre lye, after which it is polished with pumice powder and rubbed with felt in cross-forming movements. Then a solution of acetic acid and water is poured upon the plate. Sometimes a black surface appears and this should be rubbed with flannel, if this method is tried. It is also well to rub the plate with the acetic acid solution regularly and lightly until it receives a whitish-gray appearance. The plate, now of a smoke color, is ready to receive the transfer and particular attention should be taken to prevent finger-marks, etc. After the placing of the transfer, the plate must be freed from all uncleanliness by the liberal use of clear water, and afterwards gummed with thin gum arabic. Here, too, the greatest caution is necessary because, after the drying of the gum, the plate "over the gum" is to be cleaned with washing off tincture, and then rolled up with one-third transfer ink and two-thirds pen ink. When the plate is blacked equally it is for the first time wiped with water, whereby the gum dissolves and the drawing, well-covered and sharp, remains. The printing plate so obtained should be carefully powdered with talc or resin, and etched for the first time. The etching must be performed with the greatest judgment and for this several minutes of time is required.

To secure a good etching, two stock solutions must be made; first, a thick gum arabic solution, which must be strained through fine gauze, by which means all impurities are cleared off; second, a cold saturated alum solution must be made, in which so much alum is dissolved that it leaves a surplus at the bottom of the bottle. Sulphuric acid clay may also be used for this purpose. Seventy-five parts of gum and twenty-five parts of alum solution are well mixed, and 3 to 5 parts of nitric acid are added to it. This mixture is left to stand for some hours and then it is fit for use.

The etching is performed as follows: The plate is flowed over with the above described etching solution and left to act for from three to five minutes. During this time it is well to regulate it over the plate with a sponge or soft brush, without rubbing hard. Meantime stains and such things must be removed with the corrector's hone or a piece of charcoal. After this the superfluous acid is removed, but this must not be poured back into the stock bottle—it must be thrown away. The plate has now, on the parts where there is no drawing, a whitish gray coat, which possesses a water attracting surface, and is, after repeatedly well gumming, fit for printing.

If this surface should begin to tone, it can, after the first inking, be etched again in the same way, whereby the difficulty will disappear.

It may be remembered here that the acid mixture must not be used strongly, as too much acid forms a coating, which would leave the plate blank. If the etching solution, after the time given, has not formed a suitable surface, which is very easy to prove by scraping with a broad needle, then the etching solution must be used weaker. Corrections may be very easily made by this method: either polish with felt or pumice powder or acidulate with thin vinegar or sulphuric acid, or lightly scratch it with scraper or needle, only be careful that these parts are etched according to the rules given.

Oxidation of the plates is excluded by this method, and they may be preserved for years without in the least degree deteriorating. A favorite method of engraving on metal plates which have been prepared is to etch the surface well, gum up and dry and then wash off thoroughly. Then coat thinly with an asphaltum resist composition of 1 part yellow beeswax to 5 parts Syrian asphaltum melted together in a bowl, after which benzol or spirits of turpentine is evenly spread over the plate with a broad camel-hair brush.

The operation of coating should take place as quickly as possible in a room free from dust. Any detached hairs left from the brush after the coating must be removed. To give the coating a dark color, the plate is gently warmed and then held over a candle so that the smoke will mix with the asphaltum film which has become soft, and penetrate through the application of heat. An almost even black appearance will result, which will permit the engraver to see his work more clearly as it progresses.

When the plate is cool the drawing or image is traced on this blackened surface with "set-off" paper. It is then engraved by means of needles of different thickness, after the points have been slightly rounded off on glass. It is not necessary that the needles should actually cut into the metal, as it is sufficient if the coating be just removed, and the metal bared in the places where the lines are made. It is, however, preferable that the needles should just touch the plate, or faintly scratch its surface, rather than that the asphaltum should not be removed by the needle. When the whole of the design is completed, any accidental incisions or scratches should be covered with asphaltum solution, and when this has dried the plate is treated with an acid bath. The engraving may now be inked in by means of a dauber and printed from in the same way as stone engravings, or in order to be able to use an ordinary nap roller for inking in and to print direct from the plate the following procedure may be adopted: First, ink in by means of a dauber with good black ink, dust in with fine resin powder, chalk with French chalk, then heat the plate to cause the resin powder to fuse, and finally etch the plate with a special high etching solution. This solution is applied for a few minutes until the deepest parts become sufficiently flat to be inked in with a nap roller.

If so desired the etching of the plate may be carried out in tone-stages, first etching for the finest parts, from about a half to two minutes, according to the grade of the lines, and the tone values of image; then stopping out these finest parts with the asphaltum resist composition, and pursuing the etching for the next grade of tone, repeating this procedure until all the gradations are produced. This tone etching may also be done without the stopping out operation by conducting the etching of the various gradations with a brush as with etching machine engravings on stone.

Commercial designing is a trade of its own and while learning his trade the commercial engraver is usually not instructed in designing, but later, when working in a smaller litho establishment he is often required to make his own sketches, it being taken as a matter of course that he ought to know.

Now for the benefit of these workers it is suggested that the first and most important point for satisfactory wash sketches is the sketchboard.

This should be a rough surface (kid finish) bristol board. If for some reason the rough surface kind should not be on hand, take a smooth surface bristol, hold it under the hydrant and let the water run freely over both sides of the paper for a few minutes. When dry it will be ready for sketching.

The wash fluid should consist of: rubbed India ink, adding a little prussian blue or dark green, and some gamboge—this should be a pretty strong tint—then take some of the mixture in another saucer, adding a few drops of water, making a lighter tint of the same color, for the lighter shades.

After the layout is made with a hard pencil, the black or solid work is done first, with waterproof ink. The open lettering and other fine lines required to appear on the sketch to be outlined with the darker wash fluid, using a fine pen.

After this, thoroughly clean the sheet with a soft rubber, taking off the pencil and other marks.

When washing the cloud effect, or background in the design, apply the lighter wash fluid where the tint is to be strongest, then dip the brush in clean water (just a little) and work the tint towards the lighter points. Another brush with nothing but clean water, should be used for the extreme ends and lightest parts. Shading of lettering to be put in last, with the darker fluid.

In designing script, the top and bottom guidelines, and the general layout, should be drawn with a well-sharpened moderately soft pencil, then go over the lettering with a hard pencil, using some pressure in doing so, after this, clean the sheet with a soft rubber, which will take everything off the sketch except the sharp lines made with the hard pencil. Cut in the body lines with rubbed India ink.

This process will be found very simple and satisfactory to the man with limited experience, and might prove beneficial to the older craftsmen.

While metal plates are prepared to receive transfers or drawings in numerous ways, some of the prepared plates do not require any treatment at all before drawing or transferring except to be wiped off with a piece of clean cheese cloth to eliminate dust from the surface; where the surface is not so prepared they may be treated by any one of a dozen means. They may be first polished, for instance, with pumice and try-stone. In the graining process, to obtain a matt surface it is well to use pumice, emery and glass-powder, much the same way as stones are made ready, or they may receive a fine grain, or "tooth," by means of an acid bath as previously set forth. The sand blast, which gives a fine granulated surface not unlike a very fine grained stone, is the favorite method in Germany. After the plates have been thus treated they should be immersed in a bath of alum, water and nitric acid as before mentioned. After the acid bath they must be thoroughly washed with clean water and promptly dried. A stoneware or enamelled trough is required for the bath and it is better, and more economical in the end, if the backs of the plates are protected with an acid resist, such as a coating of asphaltum.

In roughening the surface of the plate after the bath a favorite method among those who have adopted metal, is to place a plate on a perfectly flat, thick wooden board or on a litho stone, with a sheet of damp felt underneath to prevent movement. It is then damped and pumice powder sifted over it. A wooden block covered with a piece of close felt or flannel is then used as a grainer, the operator bearing heavily upon it and moving it continuously with a circular motion over every part of the plate. When the powder, in working, assumes a black slimy condition it should be washed off with water from a tap or through an India rubber tube and fresh powder sifted over the plate. It will take about forty minutes and three or four renewals of powder to properly roughen a 25 x 38 inch plate. When the roughening is completed and the plate thoroughly washed, the water may be removed by means of a "squeegee." The plate will now dry quickly and should have a beautiful, dull silver-like appearance, and is ready for use.

To obtain a more decided grain for chalk drawing, a different treatment, owing to the difficulty in graining the metal, is required. This treatment consists of the plate being fastened in a wooden tray and a large number of smaller or larger glass balls, with finer or coarser sand according to the quality of grain required, along with a supply of water, being moved about on the surface of the plate by means of a rocking motion given to the tray containing the plate and balls. A special apparatus for this purpose is supplied by the proprietors of the various metal plate processes.

Drawing on metal plates is done exactly as on stone, with pen or brush and liquid ink on the ordinary plates, or with chalk on plates grained for the purpose. A soft lead pencil may be used for sketching or outlining on the plate, or charcoal if the subject is a large one. For tracing red chalked paper is the safest and most useful. Oily tracing paper must be carefully avoided. It is necessary not to attempt to pick or scrape the plate for alteration. Anything drawn wrong will be better left alone and altered after the plate has been rolled up and prepared.

Transferring on Metal Plates

THE operation of transferring work to metal plates, whether of zinc or aluminum, is almost the same as that for stone. As a general rule the plates, being thin, require for convenience in working, to be placed on a stone with a wet sheet of paper underneath to prevent slipping, although there are other methods which will be dealt with later. As a set rule, it is not advisable to heat the plates; if any heat should be required, however, for some special work the stone may be slightly warmed, which will answer every purpose. The work is then damped and transferred in the usual way. These plate transfers should be passed through on sheets of paper twice, as a general rule, to remove all superfluous ink. It is a good thing, and should invariably be carried out, to pass all plate transfers through the litho press, face down, on a sheet of smooth printing paper, afterwards heating them off before a fire.

While the general method of lithographing from metal plates is somewhat similar to that used in printing from stone, there is enough difference to puzzle some very clever lithographers, and those who are about to adopt the new process will find the suggestions and rules laid down here to be of considerable importance. While there is no absolute rule laid down for using metal plates, the reader will find that he will be able to accomplish more easily and successfully that which he sets out to do if he follows these suggestions. The fact that the offset process of lithographing calls for the use of plates instead of stone, and that hundreds of establishments have recently adopted the offset press, makes a knowledge of metal plate printing more desirable just now than at any other period.

After the transfer has been made and the starch has been removed from the plate, the transferrer covers the surface of the plate with strong gum and this is rubbed up while the plate is still wet. It is then washed out with an asphaltum solution on the dry gum. This solution is generally of a very greasy nature, else the work will not roll up solid. After it is washed out with the asphaltum solution, it is then washed off with water and rolled up. When the work has become fully charged with ink it is dusted with resin and French chalk and etched with etching solution. Every maker of plates for lithographic purposes supplies a special solution, and as a majority of lithographers use the plates that are specially prepared, it is advisable to obtain this solution from the manufacturer of the plate in use.

After the plate has been etched, it is thoroughly cleaned with water and then gummed up, and the gum fanned dry. After washing it out with the asphaltum solution on the dry gum, it is ready for the press and all that is necessary is to wash the plate off with water, roll up and print.

When using the prepared metal plates, careful lithographers begin by having their sponges, basins and hands clean and an ample supply of clear, fresh water. It is not advisable to touch the surface of a plate of this character with the hands, as the moisture may leave a stain. The surface is first dusted off with a clean cheese cloth and if dry pumice powder should be used, it ought to be done with discretion, as it is liable to remove the prepared surface of the plate and cause the work to tint.

The impressions should be pulled very black, but at the same time sharp, using about one-half good black ink and one-half good transfer ink, reduced with a No. 000 or No. 00 varnish. When the transfer is patched up it should be pulled through the same as a stone transfer, using slightly more pressure. The plate can either be laid on a stone or on an iron bed, the latter being preferable, as it is less liable to break. A small quantity of gum put under the plate before pulling through the transfer press will cause it to hold firmly to the stone or iron bed, which will be an advantage when rolling up.

The plate should be pulled through sufficiently to transfer the work from the paper to the metal, after which the paper is soaked off. Great care should be taken to remove all starch from the plate as this would have a tendency to cause a tint when rolling up. After the plate has been thoroughly rinsed with water, fan it dry, and, where necessary, touch up either with tusche, litho crayon or lead pencil.

After the plate has been touched up, gum it up, having the gum about the consistency of syrup, and rub it up before the gum is allowed to dry on the plate. If it is a large plate, it is best to gum only a small portion at a time, as when the gum dries it acts as an etch. The rubbing up ink should be any good black ink reduced with thin varnish and turpentine, but use as little turpentine as possible, as, when it is too freely used, it may cause a tint. The plate will not rub up solid, but will roll up after the first etch, after being washed out with the asphaltum solution. When the work is sufficiently rubbed up, wash the surplus gum and ink off with clean water and fan dry; powder with resin and French chalk and etch with good, strong etching solution, after which wash the plate with clean water and gum up, taking care to rub the gum smooth and fan dry. The plate is then washed off with an asphaltum solution; rub this smooth and fan dry, after which wash the plate off with clean water and proceed to roll up, using a good black ink reduced with a No. 00 varnish for this purpose. When sufficiently rolled up, again resin and powder with French chalk, then proceed to clean out dirt spots, etc., using a pointed piece of wood and pumice powder, or snake slip, for the purpose. A Gamberger stone is also very good for polishing out work on metal plates. After this the plate is etched with etching solution very strong; this is washed off with clean water, the plate is again gummed up and fanned dry, washed out with the asphaltum solution and is then ready for the offset press.

In rolling up the metal plates a great many people use the ink too stiff—this is a mistake. It will be found much better to use a very thin ink. The plate will roll up much easier and not catch up as quickly.

This is just the reverse from the litho stone. In fact all inks used on metal plates, both for transferring and steam press printing should be ground very short. A small quantity of machine oil or varnish mixed with the ink will sometimes stop a tint where stiff varnish would not.

In patching up a job great care should be taken to prevent any dust from settling on the impressions, as metal plates are extremely sensitive. This is a very important feature to be considered when bronze powder is floating about through the shop. This may appear a small matter, but it is of the greatest importance. Many a transferrer has wasted a whole day in cleaning out small black spots on a plate when it could have been avoided by a little care in keeping the transfer impression covered up.

It is always best to use a damp transfer paper, but should it be necessary to dampen the plate, a weak solution of alum water will be found beneficial. It should be applied to the metal plate freely and with a clean piece of cheese cloth, and gradually rubbed smooth and when sufficiently dry the transfer should be laid down with rapidity.

Do not attempt to wash the plate out as you would stone. Always gum the plate and wash out with the asphaltum solution on the dry gum. Use plenty of clean water in making these transfers, which will mean success to any one attempting to make transfers to metal plates.

The following method of transferring to metal plates is based on the experience of a transferrer who is familiar not only with metal plates, but who is one of the most expert men in this country:

In making a commercial transfer for the offset press, when the engraving is made for stone work use two kinds of India transfer paper; one piece should be slightly more damp than the other; pull a good, clean, sharp impression from the engraving on the dryer piece, and, if satisfactorily made, take this impression and make a reverse at once (never pull all your impressions of the job at one time)—reverse each impression right away by laying a piece of soft enameled paper, face up, on the stone, then place the blank piece of India (damp) paper on this face up and on top place your impression and a soft backer (a rubber sheet), and pull through with medium pressure; then take a clean sponge with clean water, first loosening the edges of both impressions, and quickly pass over the top of the impression pulled from the engraving, and before it gets a chance to get wet through pull the impression apart. This will leave the work retransferred on the blank piece. This requires a little practice, but it is a good way.

Another way is to place a damp blotter on top instead of the rubber sheet. After having all your impressions pulled to your satisfaction, you proceed the same as you would for a stone in regard to laying out your sheet and sticking up, etc., allowing for gripper not less than ⅜ to ¼ inch—taking care in sticking up that your impressions are not all reversed so as to avoid making a mistake in the reading matter of the job in hand.

Having your job stuck down O. K., you place a large unused stone in the press and get your plate, we will say one 19 x 30, and your work is a check, 5 on with stub; place your plate on the stone, first carefully rubbing away every lumpy speck from the surface of the stone to avoid lumps on the plate, then, with a clean cloth, wipe off both sides of your plate, using a piece of cloth for the back by laying the plate on a sheet of clean paper face down, then dampening your stone and lay your plate with two edges (side and gripper) close to the edge of the stone towards you; now get a scraper 19 inches wide (taking care not to use this scraper for anything else but for your zinc transfers); set your scraper and get your pressure, using a little more pressure than on stone, using 2 or 3 sheets of soft newspaper (blank) for backer; you then take a clean cloth and rub over the surface of your plate to remove all dust and dirt; then take your rule and measure and make a center line of 30 inches (15 inches), then measure 1⅛ inch from the end of plate and make two small marks as a guide to lay your sheet on (this is for gripper allowance); now you dampen a sheet of paper and lay it on your work (don't dampen the plate). When sufficiently damp or tacky, take your work and lay the stub end of your check on the two marks of the plate, put your backer on top and pull through about three or four times back and forward; afterward you take your plate up and turn it around with the gripper end opposite yourself, but lay the plate on the stone the same. Now dampen a sheet of paper and lay on top, using the same backer and pull through again three or four times as before, and turn your plate again and proceed the same way again, using a lighter pressure this time to avoid sliding; care should be taken in this course, or it is likely to spoil your job. After having sufficiently dampened your work, you proceed to wash off the transfer paper by a good soaking. Wash your plate off clean. Be sure every bit of starch is washed off. You then dry your plate, get good fresh tusche and tusche up wherever it is necessary and gum up your plate with a good gum. Do not gum too thick and rub the gum down smooth with a clean gum cloth.

After your plate is dry, scrape your roller and use a medium thin ink with 00 varnish on roller. Now wash off the gum with clean water and dampen the plate ready for rolling up the work—care to be taken that it does not catch up. Roll over the plate about three or four times to give the work a start, then dry the plate and if any tusching is required, do it, and after this gum up the plate again and rub smooth and dry. Now wash out your plate with turps, on top of the gum, dry plate with a clean rag until all the work is dissolved, then pour a few drops of prepared asphaltum on the plate and with another clean rag go over the whole plate until smooth and dry. Now take your sponge and clean water and wash off the plate until all superfluous asphaltum is removed and your plate looks clean; then proceed to dampen and roll up, gradually getting your work up until it becomes firm and clean and proceed the same as you would on a stone—only taking care you don't overcharge it with ink, using the ink somewhat thinner than on stone, and using it sparingly. When rolled up sufficiently, dry and resin, using sifted resin. Then you clean out your plate with a scotch stone, but never use a needle point to scrape as the plate will show these scrapings on the rubber blanket and may be the cause of making your transfer over.

After the plate is ready for etching, dry and resin again, go over with French chalk, and proceed to etch with etching fluid. After the etch gum up the plate again and dry smooth. Then wash out the plate with the asphaltum as before and give it to the pressman. If a second etch is necessary, proceed as before and use a stronger etching solution.

In order to get a good negative on a metal plate, first pull a good sharp proof from the job to be worked, on dry transfer paper, first rubbing the paper with talcum powder. Then clean it up well. After the impression is made sprinkle some fine powdered oxalic acid over it, and leave it on five or ten minutes, then clean with a fine brush or a little cotton. It is essential that the oxalic acid be thoroughly removed from the paper in order to insure a good transfer, but of course enough should be left on to do the work.

Now comes the transferring. Take a good, polished smooth plate, roll it up good and solid with strong pen ink and pull the powdered impression through like a regular transfer. It might be well to wet the four corners of the paper in order to be sure that it will stick firmly to the plate.

Care should be taken in dampening the transfer paper not to get it too wet. It will be best to simply dampen the back of it, as the oxalic acid will dissolve in water and cause the lines to lose their sharpness. The pulling through of the transfer needs a little experience in order to learn just how many times it should be pulled through, as too many pulls are likely to spoil the impression. The dissolving of the transfer paper can best be done with a weak solution of zinc or aluminum acid or gum, which should be left on a few minutes and then the plate should be placed under running water until all the paper has run away. Then wash with a soft sponge until the drawing comes out nice and plain. After this etch it with a weak solution of tannic acid. Gum it up evenly and without washing out, roll it up.

In transferring to metal plates the European litho houses use all the various kinds of transfer paper that are employed for stone in their respective applications.

French transparent transfer paper, and oak varnish transparent paper are used chiefly for register color work; the usual stone to stone transfer paper is employed for the metal plate as for the stone.

A most serviceable variety of this latter paper is that known as the Dresden yellow-coated transfer paper.

For transfers from engraved stone a good quality plate transfer paper is used.

In the matter of transfer ink the same conditions are observed for metal plates as for stone, with but little exception, as the same transfer inks are used all around for both printing surfaces; the usual method being to mix one part of transfer ink with one part of a good press black ink for use on zinc plates.

This makes the transfer ink in the best condition for work, as it tones down the greenness of the greasy constituents, and at the same time increases the depth of the black coloration, so that the finest hair lines can be more distinctly seen, and the sharpest effect of transfer thus secured.

Regarding the volume of ink on the transfer paper, as compared to that required for stone, it is a definite fact that transfers for running down to metal plates should be pulled fuller of ink than they would be if pulled for use on stone; yet notwithstanding this fact, these transfers will yield a sharper print from the plate than can be obtained from the stone. This is one of the valued assets of metal plate printing, that infinitely sharper and finer work can be done from the metal printing surface than can be done from lithographic stone, which gives a more thick effect in printing than is secured from the plate.

After the plate has been roughened and prepared in the manner described, the transferrer proceeds to carry out the actual transferring operations. In some cases the boxwood, or pear tree wood press scraper is first levelled up true to plane and this is done by rubbing its V-shaped edge upon sheets of glass paper, or Cabinet paper, as it is variously termed, and these are spread across the transferring bed for the rubbing operation so as to insure that the two actuating pressure surfaces shall be made parallel and conforming to each other.

The metal plate being laid upon its support in the press, which may either be a special iron bed or a litho stone, is carefully dusted to free it from all loose fibres or other adhering matter to prevent scumming or undue friction.

The surface of the plate support is likewise dusted over with a clean rag for similar reasons.

Further, the printing plate surface itself is always most carefully wiped over before transferring upon it or "damped," as the requirements of the different classes of transfer papers that is being used may dictate.

In this connection of the preliminary plate dampening operation, it may not be amiss to here point out the important differences that are set up when a plate is dampened with a soft, fluffy cloth, as compared with the same performance when applied to a smooth, polished stone.

The printing plate surface being a rough, matt, granular character, causes the soft damp fabric to cling to it when drawn across it, which abrades from off it innumerable tiny particles of detached fibres; these become scattered over the face of the plate, often in the form of tiny pellets which interfere with the perfect transferring of the work to it, causing broken lines or tiny, superfluous "lights"—these being defects requiring "tusching up" in the subsequent making ready operations of the transfer work.

Now, as before alluded to, this peculiarity is not nearly so apparent or possible when a similar soft fabric is employed for a similar operation in dampening a stone, due to the fact that the smooth polished surface of the stone does not offer the same "tooth," or "rasping abrasion" to the soft material as the roughened metal plate surface does.

It is, therefore, essential that in order to produce the best results with a minimum of trouble, in adhering to this rule, a firm material of a fluffless character should be used; such substances may be found in the use of a fine smooth chamois leather, or a large, close-textured "cropped" sponge, which finds favor with a number of transferrers. Others use a fine corduroy material.

If, however, a soft fabric should be used for this dampening of the plate, then it must not be wrung out too tightly, in order that a plentiful supply of moisture may be retained within it, and thus be capable of being readily imparted to the plate surface, without the necessity of having to use any great friction in doing so; this will circumvent the difficulty considerably by reducing the friction.

Then when the requisite provision is made, and the proper conditions are observed and practiced, the careful, skilful transferrer is able to secure perfect transferring results from metal plates with the utmost satisfaction and precision, and much superior to that usually attainable from lithographic stone.

For the "making up" of the successive and progressive color plates in multi-color work in England, two different kinds of transfer papers are chiefly used; both of them being of the transparent character. One of these is called the "oak varnish paper" and the other one the "French transparent paper." Yet, as an exception, there are a few firms that use an opaque variety of transfer paper.

However, of the two kinds referred to, the one most generally popular is that known as the French transparent tracing transfer paper. This comprises a thin rice pulp fibre base, coated with a layer of starch and albuminous composition.

The transfer is pulled from the dry plate or stone upon this paper, and is then "shone up" to the key sheet, or to an actual sheet of the work in progress. This key sheet is usually a specially well rolled and seasoned manilla fibre paper cut from the reel in the "strong-way-run" of the fibres, *i. e.,* the direction in which it has received the greatest strain and drag in the paper making machine, so that it will have this strongest and most resistive direction available for the strain of the transfer press.

Where large size sheets are being printed, with very close registering jobs worked upon them; then the key sheet is usually one securely mounted upon a sheet of zinc, so that it shall be preserved against either contraction or expansion, and afford the most accurate and reliable registering medium for all the colors throughout the transferring operations.

There is another method but little known, and consequently but little practiced, and yet one which affords many commendable advantages and facilities peculiarly its own, and withal one which is recommended to those who require a speedy, economic and "adjustable" method for color work in progress, especially and particularly where such chromo work may be undergoing gradual expansion under printing pressure and moisture, as so many classes of modern printing papers are now only too prone to do.

This method consists in first preparing a sheet of thin yet very strong paper, of the full dimensions of the sheets being printed, and then making it translucent and impervious to moisture by varnishing it over with a penetrative coating of best pale oak varnish thinned down with turpentine. This should be done on both sides of the paper equally to obtain the maximum result; we have known, however, of its being used with the coating being applied to one side only.

When this prepared paper has become thoroughly dry, it is then ready for use, after having first dusted it over with a small quantity of French chalk (talc), which subdues any greasiness or adhesiveness that it may possess.

For use then an average sheet of the printed work in course of progress is taken from the run and laid upon the "sticking-up" board. Then on top of this is laid the prepared varnished sheet; both of them being fastened down taut and secured together to the board by means of drawing pins placed at each corner, and an additionl one or two being run through these intervening marginal spaces as additional security.

It is now assumed for illustration's sake that there is in hand a sheet 30x20 inches of colored postcards being printed in 8 colors, and that only four colors of the job have been done; the sheets having stretched considerably during the working of these four printings, so much so that it is now impossible to follow the original "key" sheet to which the first color was "shined up" to, as the dimensions of the printed colors have now become larger than the key sheet.

It becomes imperative that we must now follow the actual printed sheet itself, as when each successive color being printed upon it, the re-applied pressure causes the sheets to "go" a little each time; so that the original "key" sheet becomes less and less valuable for the usual transferring registration purposes.

Now in the method under consideration we employ one of the actual printed sheets of the job in progress, to serve us as the absolute, precise guide, for the true registration of the new set of transfers, for the next color to be printed. After this is attained we are then able to dispense with this sheet for the "running down" of them to the machine plate.

This is accomplished by "shining-up" each individual transfer on the varnish, transparent sheet which enables us to see quite clearly the whole of the printed work of the job, lying secured beneath it.

So that the outcome of this is, that we have now our next sheet of transfers fixed in absolute register position upon this transparent shining-up sheet; and this it is which we now use for running them down accurately to the machine printing plate, instead of employing the "key" sheet.

This sheet is virtually impervious to moisture, and of an unstretchable nature, due to the duplex varnish coatings which it has received; and it does not require any further maturing in the running down operations in transferring to cause it to adhere.

Therefore by its aid we are enabled to obtain the next "color set" of transfers down to the plate without misfit, and in true compensation for the vagaries of the expanding sheets of the job that is being printed. No other methods we know of offer the same manifold advantages as these, which are encompassed within the range of this ingenious system, which adapts itself to every one of the peculiar and extraordinary requirements engendered by the erratic conditions of the work involved.

Resuming again the "rolling-up" procedure, we may here appropriately refer to another method as practiced by some Austrian transferrers, which consists of sprinkling a few drops of the "asphaltum washing-out tincture" upon the black nap roller when "knocking it up" upon the ink slab at and during the time of rolling-up the new set of transfers just run down on the machine plate.

In some respects this practice is beneficial, but there are at the same time attendant drawbacks attached to it which are apt to nullify its other merits. These have been experienced from a careful testing of this method on a number of different occasions, both in America and England.

A passing consideration of the underlying principles of this practice will soon make clear the points at issue.

When the transferrer sprinkles upon his nap roller some of this "fluid washout," which consists principally of asphaltum powder, fats, and waxes dissolved in solvents such as turps and benzole. The precise formula for which is as follows:

Asphaltum powder	1 lb.
Beeswax	¼ lb.
Tallow	¼ lb.
Turps	5 pints.
Benzole	1 pint
Oil of tar	¼ pint.
Lavender oil	1 fl. oz.

This liquid solvent when sprinkled upon the black roller naturally softens and limpens the black ink with which the roller is charged. The effect of which is that this ink being then rendered temporarily flaccid and less adhesive to the leather nap of the roller, it is in this condition more readily imparted to the greasy transfer image which forms the work upon the printing plate, when the roller is passed over it in the "rolling-up" operations, and consequently causes it to become more promptly charged with its modicum of fortifying ink than would otherwise be the case without its aid.

But later on, after this black roller has been allowed to stand unmoved for a few minutes, then the turps and benzole constituents, being volatile bodies, quickly evaporate, and thus leave the rehardened wax and asphaltum substances intermingled with the ink on the roller, which then in turn becomes more hard and less distributive than ever; so that when it is again brought into use it really parts with its ink so sluggishly that the transferrer experiences infinitely more trouble in the subsequent rolling-up of his work than he would have done had he omitted the use of this "washout" altogether.

This then necessitates a constant "rescraping" of the black roller, and the "recharging" of it again with fresh ink; all of which involves extra trouble and labor upon the transferrer.

This use then of the "asphaltum tincture" with the rolling up ink may be permissible for emergency work only where a mediocre job is required to be made ready with unusual expedition, and where circumstances will permit of a speedy rectifying of the roller again to its proper condition.

But now returning to the "wash-out" procedure of the newly formed transfer upon the printing plate and the "rolling-up" of it: there is still another alternative method of accomplishing this, which is regularly adopted by the transferrers of some few litho establishments abroad.

This method consists of washing out the new transfer as before over the dried gum film; then rolling up the whole surface of the plate solid black by means of the hand roller. This permits of a full firm layer of ink being applied to the work, because in this method there is no water present to retard or diminish the feeding of the job with greasy ink.

In attaining this, however, one has necessarily to also ink up the dried gum layer on the plate surface as well as the ink work of the transfer.

An objection to this method is that it is more difficult to afterwards dissolve off the dried gum layer from the plate on account of this superimposed layer of black ink covering it up.

As an offset to this, however, it might be well to mention that a special roller for this purpose is employed by some concerns, while others adopt an additional set of damping materials.

To a certain extent the specific value of transfer paper depends entirely upon local conditions. That which might be of the utmost value to one lithographer is more than likely to fail to meet the requirements of another one. With transfer paper, as with transfer ink, or cleaning solutions, the main point is to grasp the general principles involved, because there are many varieties of each, and all of them have given more or less satisfaction according to the taste of the workman. Any intelligent workman, by adhering to the broad rules of the trade, is enabled to adapt almost any legitimate transfer paper to his immediate necessity. It is most important, however, that lithograph transfer paper, of whatever variety, should be absolutely impervious to the transfer composition or transfer ink, so that an impression of full strength may be conveyed, leaving the greasy properties of the stone or plate unimpaired. The paper must of necessity undergo special preparation, and here again the character of the work and the conditions under which it is carried out are the chief controlling elements. Until quite recently many lithographers preferred to make their own transfer paper, but at present a majority of them are using a manufactured paper that has given eminent satisfaction. Some of the older lithographers, however, make their own paper by using a good blank double foolscap paper, first thinly coating with a solution of concentrated size and afterwards varnishing with a heavy coach body varnish which gives excellent results. Paper thus prepared rarely stretches or becomes distorted to any appreciable extent and may be used with equally good results on either a cold or warm surface.

When transferring large work in which a number of printings are involved, and where accuracy of register is indispensible, the following mixture may be substituted for the coach body varnish: two quarts of best oak varnish; one pint of turpentine and one pint of boiled linseed oil. Paper thus prepared may be criticised as a rather old-fashioned method, but of the transfer papers now in use, none can claim to be exactly new.

In transferring on aluminum, work which is damped in the book, is treated in all respects as for zinc or stone. For regular work of this character to be transferred to damp plate, it is recommended by some printers to put a little common washing soda in the damping water, a teaspoonful to a quart being sufficient to make the transfer go down stronger. A difficulty which is not always so easily overcome is to damp the plate so that no streaks of water or loose fibre which come so easily from the cloth remain on the surface. It is suggested by one who has been accustomed to use both aluminum and zinc plates that a sponge of the softest and smoothest quality will leave the least amount of fibre, though even this at times may leave streaks of water. The following plan, if carried out strictly, will obviate these faults: Make a damping book of good thick plate paper by putting one sheet, passed through water, to two dry sheets, or even one to one. When equally damp through, take one of these sheets, lay it on the plate, and pass through the press under very light pressure, and lift off. This method of damping gives a beautifully smooth film of moisture. The transfer is then laid down and passed through the press very quickly to prevent it rising. After the transferring process has been gone through, warm water is poured over the plate, so that the transfer paper may be easily lifted off, the plate is washed clean, then dried, and given a very thin coating of gum, or laid aside for future preparation. In following out this process, if any touching up is required it should be done before applying the gum; lines may be joined or touched up by using the hardest possible lead pencil, while other parts can be remedied with a pen or brush in the usual way.

Those who make a specialty of aluminum, place the plate on its end, when the transferring is done, and prepare it for future use immediately. It is first fanned dry, and then thinly gummed over and washed out with a washing fluid without removing the gum, and of course without using any water. A film of the solution is allowed to remain on the plate and when dry again it is washed over with warm water, which removes the gum along with the superfluous wash-out fluid. The work is then rolled up and etched with etching solution, then dusted with either French chalk or resin, either of which will act as an acid resist.

For cleaning up aluminum plates, instead of using the ayrstone and scraper, finger marks and other slight blemishes are removed with India rubber or charcoal on a piece of felt or soft wood; strong spots and lines may be deleted by the use of sulphuric acid, or a solution composed of oxalic acid and sienna, applied with a quill or glass hair pencil. After the work is cleaned up, it is etched with an etching solution which is immediately washed off, the plate gummed up, and it is then ready for the printer.

For direct drawing this metal is slightly warmed up and dusted with talc; a soft sponge is then filled with the etching solution and spread quickly over the entire plate; the solution should then be soaked up with the sponge until there is very little remaining, after which the plate is wiped over with the gum sponge and allowed to dry. The work is afterwards washed out with the wash-out fluid and treated as already described for transfers.

In making alterations in this class of plates the process alopted by an English lithographer, and which has been copied to some extent in this country, is to first rinse well and dry and then apply the counter etching solution, allowing it to act for five minutes, and then go over the plate with a cotton pad. The real point to be aimed at in all kinds of metal plate alterations—aluminum and zinc—in deleting the work, is to get the parts of the plate required for alteration in the same state as they were when first handled for transferring.

One method for proving and preparing work on metal plates is to use the nap rollers exclusively, although some concerns prefer the rubber rollers. When the latter are used, paraffin oil is utilized to clean them instead of turps, and they are afterwards rubbed dry with magnesia.

At the outset the transferrer should make himself acquainted with the character of the work executed, by carefully examining the same and obtaining all possible information from the artist. Upon receipt of the plate the pressman should likewise familiarize himself with the work in hand. This method of co-operation prevents friction arising, if the work does not turn out exactly as desired. The transferrer cannot blame the artist after the work has been rolled up, and on the other hand the responsibility cannot be placed on the transferrer, if, before treating the plate, he calls attention to work which in his opinion is not likely to prove satisfactory. It would be well if this rule was strictly adhered to, in all branches of lithography, where work passes through several hands for completion. If the artist accepts a plate from the preparer; if the transferrer accepts a plate from the artist; or if the pressman accepts a plate from the transferrer without comment at the time he receives it, then he takes upon himself the whole responsibility of the job being in good condition at the time it was given into his charge.

As a safeguard against uneven etching or gumming up, the transferrer should commence his work by again gumming up the plate with fresh gum arabic solution, removing the old gum coating at the same operation. The plate is then dried by fanning, and laid aside while the press is made ready for working.

The first thing to consider in the preparation of the press is the bed upon which the plate has to rest, and one of the most suitable articles for this purpose is the cast iron bed, which can be obtained from all dealers in lithographic supplies.

In the event of an iron bed not being handy, a perfectly level lithographic stone may be used, and one that is nearest in size to the metal plate about to be worked from. The stone may be placed in the press and the plate laid upon it. Care should be taken that the back of the plate and the face of the stone are clean and free from grit or other foreign bodies, such as bits of paper, daubs of ink, etc., which sometimes make their appearance inadvertently on the surface of the plate, causing serious injury to the work.

The placing of a sheet of paper between the stone and plate, owing to the fact that the paper sometimes creases or crumbles after a few pulls have been made, has not found favor generally as it sometimes causes trouble and irritation.

In the event of a stone bed being used, the plate is made to adhere to its surface by damping the stone and back of plate and run both through the press with a firm pressure. The plate can then be used without fear of slipping.

The press being adjusted and clean water and sponges in readiness, the washing out is proceeded with. Wash off the thick gum, and re-gum the plate with a very thin, even coating. Then fan the plate perfectly dry, and thoroughly remove all traces of moisture. Carefully wipe the edges of the bed so that there can be no possibility of moisture coming in contact with the gum covering, owing to overlapping of rags in the subsequent operations. Now take a clean, perfectly dry rag or other soft material, such as felt or flannel, and wash out the drawing with pure turpentine, using no water to assist its action. Proceed with the washing out, turning the rag occasionally, until the whole of the drawing ink has been removed and the plate presents a clean surface. This is an operation that requires extreme care, the slightest trace of water appearing on the surface at this stage might possibly destroy the whole job.

The plate must be dried by fanning, and then rolled up perfectly solid, without damping, with a roller charged with an ink of from thin to medium consistency. The plate, at this point, presents a dense black appearance, resembling an ink slab. Sprinkle a little water on and roll up again; it will at once be noticed that wherever the water has touched, the plate appears clean, and only requires frequent damping and rolling to entirely clear the design of the ink and gum surrounding it. The roller should be scraped and a few impressions taken, when the work should be nice and sharp and the plate free from scum.

A variation of the above method is to pull an impression from the plate after it has been covered with ink. The plate will then appear gray. The plate should then be damped with the damping cloth, and another impression pulled and it will then be noticed that the plate has cleared considerably. Repeat these operations until the work is sharp and satisfactory.

Another method of washing out a drawing to avoid weakness is to wash off the ink with turpentine as before mentioned, taking great care not to injure the gum coating by allowing water to get on the surface of the plate. Then cover the plate with a greasy coating, such as palm oil, asphaltum solution, or retransfer ink, using turpentine to reduce the same to a proper consistency. When the plate has coated with a thin solution of either ~~of these, or~~ any other solution the litho printer may have at hand, it should be fanned dry to evaporate the turpentine. Now roll up until perfectly solid and black, apply a little water, and roll up again until it is perfectly clear and sharp.

The transferrer must bear in mind, whenever it is necessary to work out the drawing, never to use dirty cloths. A quantity of specially clean rags should be reserved for washing out purposes and every care should be taken to keep them in a clean condition. When the rolling up is completed to the satisfaction of the transferrer, the work is well dusted with French chalk and then given a slight etch with an acid consisting of 2 pints of nut-gall solution, 1 pint of gum arabic solution, and 1 ounce of phosphoric acid.

The plate is etched in the same manner as stone, then thoroughly washed, gummed and fanned dry. In cleaning up it is well to remove any dirt by acid or a piece of india rubber and powdered pumice stone; small specks can be cleaned away with a sharp-pointed piece of wood which has been dipped in the etching solution or into powdered pumice stone.

Again roll up the plate, using a good nap or india rubber roller. Fan dry, dust over with French chalk, etch, gum up, and fan dry again.

If the preceding instructions have been carefully carried out and the artist is satisfied that no additions or erasure are necessary, the next step of proving, or the making of set-offs, can be started.

The usual method of making set-offs is a simple operation. A number of impressions are made from the key plate on a well-rolled bright enamel paper. These impressions are then dusted with a red chalk powder by rolling a quantity of the powder over the sheet, and giving the back of the paper several sharp taps with the hand to remove superfluous dust from the surface. The dusted impressions are afterwards pulled through on a slightly dampened plate—the result being that a faint impression of the design in red chalk is left on the plate. This method has worked successfully for the litho stone, and has been also satisfactory for metal plates, although one of the chief objections, from the artist's point of view, is that the red chalk is not sufficiently distinct on the gray colored plate. Another is that the set-off is easily removed should it by accident be slightly rubbed. A third objection is that the small particles of powder adhere to the brush and pens of the artist, and so prevent free working.

One of the most effective methods of making set-offs on metal plates is the one about to be described, and one that has been recommended by skilled workers on metal plates.

Pull the impressions from the key-stone on well rolled enamel paper as before; these are then dusted over with the set-off powder by rolling a quantity of the powder over the sheet and then rubbing with a tuft of cotton wool or a camel-hair brush. The idea is to thoroughly incorporate the powder with the ink on the paper, and to remove any stray particles that may remain. The impression is then ready for transferring.

Set a plate in the press, taking all precautions as before described; damp the plate slightly, and after placing the set-off in position, transfer by pulling through the press once with a firm pressure.

The set-off will now appear on the plate in a blue color (though other colors are obtainable); the plate requires no further treatment, and is in a fit condition for the artist to work upon.

The advantages derived from the use of this powder are many, perhaps the principal being that the impression is permanent. It can be handled with much freedom, and cannot be rubbed. It can also be washed with water and yet be distinctly seen. Another good point about this powder is that no dust remains on the plate to clog the pens or brushes.

A third system of making set-offs, specially applicable for chalk drawings, and one which is said to give good results, is to take an impression from the keystone in a colored ink similar to the color to be printed. For instance, if a set-off has to be made for the red plate, a print is taken in red ink. If for the blue, the key impression is made in blue, and so on. These prints are made upon good strong paper, and pulled with a fair amount of ink on. When ready, a clean sheet of metal is set in the press, washed over with oil of turpentine, and pulled through the press with a clean sheet of paper on top. This will remove the turpentine, but should any remain fan the plate until it evaporates. Now lay the printed sheet in position and pull through the press with a good firm pressure. A good colored outline on the plate should be the result.

Let the plate stand for a few hours, and then wash well with turpentine to remove every trace of the ink. Fan the plate dry and the key will be visible without ink, and the artist has a clear impression to work to without fear of the chalks being smeared with colored powder. There need be no fear of this key stain working up in the rolling when the drawing is completed. The etching entirely destroys any slight trace of grease that may remain. The key impression will remain in the plate for a considerable period.

In the event of alterations being necessary to the existing work, roll up the plate and chalk well. The parts that require erasing are removed with a small quantity of powdered pumice stone applied with a piece of felt, or else polished lightly with a slip of snakestone.

Another method is to erase the parts with a solution of caustic soda.

When this has been accomplished satisfactorily, wash the plate well under the tap and dry. Resensitize with a solution consisting of—citric acid, ½ oz.; distilled or boiled water, 1 pint. Leave the solution on the plate for a few moments and then well wash, assisting same with a tuft of cotton wool. Dry the plate, and it is in a fit condition for the artist to work upon.

When the artist has completed the corrections, dust over with French chalk, and give a slight etch with the etching solution previously described for the artist's use. Gum up the work, dry and proceed as required.

Transferring to metal plates presents no difficulty if the ordinary amount of care is exercised in the operations. As in every other branch of the art, cleanliness must be strictly adhered to. Damping cloths must be well washed and sponges kept perfectly clean. They must not be laid indiscriminately on any portion of the press or surroundings. A good plan is to obtain a sheet of plain paper and lay them on this; there need then be no fear of their coming in contact with acids that may have been spilled on the press or tables.

Next, pay attention to the hand-roller; scrape, and work up with a little fresh ink. Also test the scraper and make it true.

Before the plates are used they should be well washed under the water tap and dried. Place the plate on the ordinary cast-iron bed or litho stone, after taking care that no dust or dirt is on the face of bed or back of plate. Set the pressure a little heavier than is usual for stone, and all is ready for transferring.

All transfers should be pulled full and sharp; writings and drawings on transfer paper should be done in a good strong ink.

Proceed with the transferring in the usual way—either damping the plate or placing the transfers in a damp book. If the transfer consists of many fine lines, the back plate can be warmed over a gas flame or in front of a fire, before the paper and composition are removed. This will give the work a much firmer hold.

When the transfer paper and composition have been soaked off, dry the plate, and do what tusching-up is necessary. If the work is in a satisfactory condition, and appears strong and firm, it can be etched slightly with an acid consisting of—nut-gall solution, 1 pint; gum solution, ½ pint; phosphoric acid, ½ oz; water, 1 pint.

But if the transfer is of a fine character, proceed with the rolling-up. Gum the plate up and dry; then wash the gum off and gum up again very thinly; fan dry and wash out with pure oil of turpentine, taking care that no moisture of any description comes in contact with the gum coating. Roll up the plate perfectly solid and black, then sprinkle on a little water and continue the rolling until clear and sharp.

We will now take up the matter of reproducing of a copper etching for lithographic printing. It must be borne in mind that this is a plate used by the printers and, for that reason, is naturally adapted to their method of work; and so, when pulling a plate of this kind, the transferrer must reproduce as nearly as possible the actual conditions existing in type printing proper. First of all, a suitable roller must be procured, as a regular half-tone copper plate must not be inked up with a lithographic hand roller, but a printer's composition roller is to be used instead.

The next thing of importance is the method of applying the pressure; and here again the printer's viewpoint must be considered. A lithographic cylinder press carries a rubber blanket which has some "give" to it, and when pulling on a hand press, soft backing sheets, rubber dam, and a leather scraper are used, not to mention the extreme softness of the transfer paper.

The cylinder on a type press has no rubber covering; nothing, in fact, but a few sheets of paper, and that shows the difference in applying the pressure. Now, in order to get the printer's pressure with soft transfer paper and a lithographic hand press, it is necessary to reverse the lithographic method, and this is done as follows: Select a level stone, an inch or so larger all around than the plate, and a scraper the size of the plate itself; then lay two sheets of super paper on the stone, put the plate and backing sheets on top of this and set the pressure on this. Here, again, it must be remembered that printers use much less pressure than lithographers, and one must be guided by that, as too much pressure will impress the dots into the paper, and that would affect the tone values. Next, roll up the plate with the composition roller, and here, in pulling, is where the reversing of methods comes in. Instead of laying the paper down on the plate, lay the paper down first, having the two sheets of super paper before mentioned between it and the stone; then lay the plate face down on the transfer paper. This will, in a measure, replace the type press condition, the stone and super paper replacing the paper covered steel cylinder or bed and taking away all the give and softness used in lithographic printing. Should the impression appear streaky, that may be the fault of the scraper; but, if the streaks persist after the scraper has been leveled up, then strips of paper can be laid on the back of the plate and they will disappear. Gum mastic is good to put into the ink, to prevent mashing when pulling with this method; and good, smooth India paper along with it, will give the best results.

Another way of working these copper plates is by making what is termed a "copper flop," and this is very good if alterations are to be made, or if one plate is to be used for several colors. A copper flop is made in this way: First, select a good gray stone and set it in the press, just as if a transfer was going to be run down on it; but, when setting the pressure, lay the plate on the stone, as its thickness must be considered. Roll the plate up and pull an impression on plate paper, in order to see whether or not the plate is taking ink properly. In rolling, do not let the roller jar or stop anywhere on the work, but roll evenly and smoothly from edge to edge. After two or three good impressions have been obtained, roll the plate again in the same manner, and instead of pulling on any paper, lay the plate face down on the stone and pull through once. Now there should be an exact reproduction of the plate on the stone reversed for offset printing. It is best to give this a light etch before it is either rubbed or rolled up, in order to keep the close parts from filling in. Then a little rolling with stiff ink will have it ready for a stronger etch, after which the work can be washed out clean with turpentine and water.

If there happens to be four or five colors on a job, it may be possible to make all of them from five of these copper flops, and it is needless to state that they will be in perfect register.

Where only one or two impressions are needed, it is all right to pull directly from the copper plate; but then it is necessary to wash out the plate with benzine, every time an impression is pulled, otherwise the places between the dots will become choked up from the coating of the transfer paper, and then these parts which are meant to remain white take ink and so produce a flat solid, where an open screen should be. This naturally robs the design of some of its effect and it cannot very well be remedied later on by etching. A copper flop, when once on a plate or stone can be handled the same as other work and so be properly controlled, and, where it is at all possible, it is the best thing to use.

When a plate is to be made by a photo-engraver for use of this kind in a lithographic establishment, he must be warned to leave sufficient metal around the work, to enable the transferrer to get a grip with the scraper and some space to lap transfer paper over on —an inch all around is about the least that should be given.

There is no valid reason why a photo-engraver cannot make a plate for a photo-lithographer to work from, except the photo-engraver himself. Some photo-engravers seem to think that if the lithographer is going to use metal plates he must be made to use the ones the photo-engraver has always made, and they insist on stripping and turning the film before finishing up the plate. Of course this is all wrong and many photo-engravers have lost some very good-paying work by this sort of reasoning, but there are a few of them who seem willing to learn—and some have already learned—that offset lithography has come to stay and they must either learn to make plates for lithographers to work from or lose the best part of their trade. There are some photo-engravers in this country, however, who are making a specialty of plates for offset lithographers and they are working up good and well paying business. In the near future there will be many more doing the same thing.

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Re-transferring

IT may be of interest right here to chronicle a good method of transferring from left to right. By laying a properly prepared metal plate directly upon the stone upon which an engraving or drawing has been made (of course having previously been charged with transfer ink) placing the usual backing sheets upon it, and pulling through the press with strong pressure, an impression will be obtained thereon equal in every respect to the original. The counterpart of the original is now to be treated precisely the same as any other transfer made on metal plates; that is to say, it should be gummed up lightly, dried, washed off with water and strengthened by rolling up. The completed transfer is only to serve as an original from which the regular transfer impressions are to be made by the aid of the regular transfer paper to another plate, or stone.

It will be observed that this method makes it possible to squash an impression from one piece of paper to another, for the transferrer now has two plates to work from, if he is contemplating a "from left to right transfer;" at any event he is working from an original, as near as the term can be applied.

By this process we understand a mode of transferring which is to complete, for instance, the right half of a drawing or engraving, of which the half only was made, or perhaps one-quarter only was necessary to engrave, and all the rest was left for the transferrer to complete. It is possible to get good results from plates not processed, of course, but it is advisable to secure these plates from competent plate-makers, who know exactly what is needed in this work, and any kinking, or other troubles that often follow home-made plates, is obviated. In completing these "left to right transfers" the plate is taken from the stone and thoroughly cleaned, then rubbed down with pumice powder and a ball of paper, or a felt pad, and water; again rinsed, flowing in a citric acid solution, say 15-20 parts chemically pure citric acid (crystals) in 100 parts water. Care must be taken to apply this solution evenly. After three minutes the plate may be rinsed again, taking chemically purified cotton to rub the plate dry, the object being to remove all traces of crystalline metal. A thoroughly dry cloth is finally used to complete the drying, and the plate must then show no stripes or spots, if a thoroughly serviceable original transfer is desired.

Should it happen that the first effort did not result in a successful original, the plate can be again used by removing the ink with turpentine and a rag, then using another rag with benzine, which will take out all the grease, finally using pumice powder; the plate is given a good polish with that, again rinsed, and prepared with the citric acid solution.

In the event that a plate has been standing a long time with a transfer upon it, it should be treated, after the turpentine and benzine application, with a flooding of hot soda in order to saponify the settled fat, which might have drawn into the plate.

A great many ideas about the various methods of transferring have been set forth in this book, and while as we have previously stated, there is no hard and fast rule—every transferrer having his own ideas about the way his work should be performed—there is enough material to interest the man who is seeking light on the way other people work.

Re-transferring from Type

WHILE there has always been some demand for transfers from type in the lithographic establishments of the country, the advent of the offset press has increased the use of such transfers very largely.

Of course all type transfers have to be reversed for the offset press. The type page, from the first introduction of movable type, has been "negative." To imprint direct on paper would, of course, be "positive." The difficulty of re-transferring from the type form to the metal plate of the offset press has discouraged many good transferrers. Fortunately considerable progress has been made in this part of the business and many difficulties have been overcome.

When the offset press was first introduced it was the prevailing custom to reverse the type forms in the same manner in which the old engravings were reversed—the paper to paper method. Of course a type press of some kind had to be used as the pressure in type printing—except in the case of the cylinder press—is entirely different from that used in stone printing. It is practically impossible to print a type form on a lithographic transfer press—the same thing applies to an attempt to print from stone on a type press. The one calls for a direct pressure and the other for a "scraping" or sliding motion.

As the average lithographic transferrer had little or no knowledge of type printing, and as the type printer had no knowledge of lithography, it usually took two men to make a transfer from a type form to a printing plate. This condition still exists, for that matter, especially where fine work is to be transferred.

In the "paper to paper" process it is best to have the page or form to be printed "made ready" on a type press by a type pressman. This should be done with ordinary type ink. See that every letter shows up plainly on the proof and that the cuts print clear and clean. Make the impression light, but not so light that there will be anything omitted. Now wash the type ink off carefully and thoroughly and ink up the rollers with transfer ink and pull an impression on dry transfer paper. Place this impression face down on a piece of damp transfer paper and run the two pieces through the transfer press with a firm pressure. The damp sheet will now show the form in the negative and be ready to put down on the printing plate of the offset press.

In the transferring of the positive image on the dry sheet of transfer paper to the negative on the damp sheet there is always great danger of "squashing" it and spoiling the transfer. This danger is so great that many efforts have been made to do away with the process entirely.

Probably the most successful method of making a re-transfer from type is known as the rubber blanket method. This is practically the same as that previously mentioned, with this exception: In the place of the dry piece of transfer paper upon which the type impression is taken, a piece of rubber printing blanket is used. This is laid smoothly upon the tympan of the printing press and a light impression is made upon it with transfer ink. The regular offset blanket is best to use. This impression, of course, appears in the positive. Now place the rubber blanket in the transfer press and lay a dampened piece of transfer paper on it face down. Pull it through and you have the negative transfer that is used to lay down on the printing plate of the offset press. This method has been found to be very successful and one enterprising transferrer has patented a machine for stretching and holding the rubber blanket taut while the impression is being taken. The machine is well worth all that is asked for it as it facilitates matters considerably. By this rubber blanket method a perfect transfer can be made nearly every time if a little care is taken.

Still another method is known as the zinc plate process. This is done by substituting a soft, thin zinc plate for the rubber blanket, pulling an impression direct from the type on the plate and then taking the negative transfers from the plate for putting down on the printing plate of the offset press. One great advantage of this method is that the plates can be laid away and kept as originals in case the work should ever have to be duplicated.

One of the latest and most valuable machines that has been invented for the lithographer is the rubber blanket cylinder hand press. This machine does away with most of the hardship connected with reverse type transfers, as well as with the old paper to paper transfers where a stone engraving is to be reversed for the offset press. With this press a page of type is placed on the bed, which can be raised and lowered with little trouble, an impression is taken on the rubber blanket from the type, the metal plate or transfer paper is then placed on the bed of the press, the cylinder rolled over it and the image is thus transposed to the place where it is wanted. Several different makes of this kind of press are now on the market and they save a great deal of hard work for the transferrer, and the work turned out by them is superior to that of the old fashioned hand press.

A transferrer is one of the most important assistants to successful lithographing and the transferrer who can do the same thing in more ways than one is the man sought these days. As nearly every conceivable mode of transferring has been touched upon here there is no reason why the man who has never had anything to do with metal plates ought not to familiarize himself with the latest plan of operation. If he is interested in his work and desires to keep up to the times a close study of the schemes here outlined will, we trust, be of value to him in promoting his ambition.

Proving

UNDER the head of Proving we can give a few general rules and hints on the working of metal plates in the transfer press. Little need be written at this time on the mixing and matching of colors and other matters of general experience, the object being to simply point out the little differences between this process and that of working from stone.

In the first place, look to your roller, and make sure it is adapted to the work in hand. Keep it in good condition by applying a stiff brush now and then. India rubber rollers are good, but they require considerable attention to keep them in condition. For cleaning purposes use paraffin, and after drying with clean cloth, dust over with French chalk. The life of an India rubber roller is much shorter than those with leather coverings. Therefore, for good, serviceable use the nap roller gives satisfaction in most quarters.

Have the inks a little stiffer than for stone work. Clean cloths and surroundings are essential. The plate should not be allowed to stand with a damp surface; if the work has to be left for a few moments always gum up evenly and fan dry.

If trouble arises owing to the presence of scum, add a little tannic acid to the damping water. Or the addition of a little magnesia or starch to the ink will help to remedy this evil. Other remedies for scumming are the use of vinegar, cold tea or other slightly acid fluids in the damping water. If the scum is not easily removed, roll up in black, dust with French chalk and give the plate a sharp etch with the nut-gall etching solution, fan dry, gum up and again fan dry, then proceed.

Sometimes trouble is caused through the edges of the plate taking the ink, and applications of the various etching solutions fail to keep them clean. When such is the case the use of a solution of caustic soda will be found very beneficial.

A frequent cause of spoilage of designs upon plates is owing to the fact that sufficient care is not exercised in the washing-out process. Occasionally, it will happen that the plate is gummed up with a thick coating, which prevents the turpentine from penetrating sufficiently to remove the inks. The plate presents a patchy appearance and the workman loses his patience and applies a little water to assist matters. The result is disastrous to good work. If not at once apparent, the edges of the design in a short time will present a feathery appearance, and the finer lines will lose their sharpness. Therefore, immediately the washing out has been completed, roll up the plate in black ink, chalk and etch.

The moral is to gum up the plate very thinly and evenly; do not use a strong grease for washing out unless the work is weakly. Ordinary printing inks of good quality are sufficiently strong for average purposes.

Alterations

ALTERATIONS, whether on stone or metal, are always troublesome and are not uniformly successful. An authority on alterations has this to say about that feature of the work:

The work should be rolled up with a strong black ink and dusted over with French chalk (talc). Remove the part which requires altering with a mixture of half etching solution and half turpentine on a small, clean piece of flannel and rinse well with water, then apply a solution which consists of a strong alkaline to destroy the grease. Care should be taken not to touch the remaining work, as this solution would destroy it. The alkaline solution is gently rubbed with a small piece of felt or flannel in all directions for one or two minutes over the part where the old work has been removed, and then well rinsed with water. Then pour a few drops of solution on a small piece of sponge and rub over the part which should receive the alteration and again rinse with plenty of water. This operation should be repeated two or three times to secure success. Now the plate is dried; then a few drops of coating solution is poured on the plate and brushed with a soft, clean nail brush till the coating is thoroughly dry, when the prepared part of the plate is ready to be drawn upon.

The one thing needful in order that alterations may be satisfactorily made, is to have the plate perfectly free from grease, gum and dirt; in short, to have a chemically clean or sensitive surface, such as existed when it came from the makers.

After this the plate is washed thoroughly on both sides with a copious supply of perfectly clean water, taking care that no scum of the bath remains upon its surface; it is then rapidly dried, either over a heater, or in a hot air chamber to prevent streak markings, or oxidation through slow, faulty drying in a cold atmosphere. The plate is then ready for either the litho transferrer, artist, or engraver.

The chief merits of metal plate printing, whether from zinc or aluminum, prepared, or unprepared plates, are economy, speed, simplicity and efficiency, and we are confident that such merits will appeal to all lithographic establishments desirous of progress.

Preserving the Plates

BEFORE outlining more fully the various recipes and methods in vogue in the preparatory work, it might be well to state in passing that the preservation of plates, after they have been received in the shop, is of vast importance. The storing away of plates—and for that matter the same applies to stone—without proper precautions for preventing deterioration, is harmful in the extreme. It is, in fact, by no means rare, when some future printer comes to utilize these reserve plates, to find that they present many serious difficulties to the execution of good work, solely through the want of the most ordinary precautions.

Possibly the design has become weak and only takes the ink with difficulty, and the delicate parts do not print sufficiently dark. The printer may try all he knows to impart new vigor to the work, only to find that his efforts accentuate the defects and blacken the surface of the plate or stone, which thereby loses its tonality.

If the metal plates bear designs full of little elevated points and hollows which become unduly prominent in working—thus destroying all harmony of design and giving the impressions a disagreeable appearance—it is easy, when they appear in the white spaces, to remove these points by the aid of a scraper. It is not so easy, however, when they show in the design, for if the impression which appears is a little sensitive, the scraping accentuates them, and the retouching which is subsequently made becomes useless for careful work.

Such accidents are generally due to the effect of the atmospheric conditions of the storeroom the plates are kept in. These places, it must be said, are often the most unsanitary or out-of-the-way parts of the workshop. Often the storeroom for stones or plates is near to some damp place, the emanation from which softens and destroys the coating of gum; or the gum becomes acid and gradually destroys the plate left exposed without defence to the pernicious effects of damp air saturated with evil vapors. The compositions turn sour, and very soon the work of destruction is accomplished. It is mostly in small offices that we find these infectious influences. There stones and plates are heaped together promiscuously, and sacrificed in advance to almost certain deterioration. The only excuse is the want of space. It is easily possible to render stones insensible to humidity, but the metal plates should, by all means, be kept in a dry place. To render the plates damp proof, as far as possible, when the job is worked off, they should be gummed up with a cold solution of gum arabic to which some bichromate of potash has been added.

The coating given ought to be very regular, thin, and very rapidly applied. When it is dry the plate should be exposed to light for half to three-quarters of an hour. This produces a combination of the gum with the chromic acid. The coating becomes invulnerable to damp, and the plate is protected against all oxidation. After having been exposed, the plate is gummed afresh with ordinary gum, being careful that it is not sour, which would oxidize the plate.

When it is required to use the plate after being in store for any time, it is sufficient to wash it with water to which 1 to 2 per cent. of phosphoric acid has been added. The coat of bichromatized gum is rapidly dissolved, and the plate is then ready for printing. In order to preserve the work on metal plates when they are to be stored away for a considerable time, the following method has found favor in many houses:

The printing ink should be washed off the plate, and the job must then be rolled up in a non-drying preservative ink which will not oxidize on contact with the atmosphere. This ink is generally compounded by the printer himself and sufficient quantity mixed up to be kept in stock, so as to last for a considerable time. It is prepared as follows:

Spermaceti	4 oz.
Beeswax	6 oz.
Good Black Litho. Ink	4 oz.
Olive Oil	1 fluid oz.
Glycerine	½ oz.

The wax and spermaceti should be melted first, then the ink added in small quantities till dissolved, and the oil well incorporated. Tallow may be used in place of the spermaceti if desired, but the latter is the best. A special nap roller should be kept for this ink, and all jobs on plates that have to stand a long time should be rolled in with this ink before putting away. There will then be no danger or trouble in washing out when required again. If necessary, the ink can be softened still more by the addition of a few drops of turps before applying to the roller.

Another and more simple way is to gum the plate up with thin gum which is rubbed very smooth and fanned dry. Then wash out with an asphaltum solution composed of asphaltum, beeswax, tallow and turpentine, which can be purchased from almost any supply house which deals in metal plates, at a reasonable price. This method is much more simple, as it requires no rolling up and has been used successfully in some quarters.

Offset Press Work

LITHOGRAPHIC machine printing presents many peculiar features, each one of which requires careful and constant attention for its successful operation. The pressroom being the most important department in the lithographic establishment, it becomes imperative that the presses are made to run to their utmost capacity, whether they be flat-beds, rotaries or offset machines. A small amount of dirt will make more trouble for a pressman who is printing from metal plates than any one thing that he comes in contact with. This matter of cleanliness extends to the back of the plate that is to be used as well as the surface. It is, therefore, necessary to see that the back of the plate is thoroughly clean before the plate is clamped on the press; it should be wiped off carefully, and the cylinder as well, to prevent particles of dust and sand from lying between the bed and the plate.

Another important thing to remember is to have good grained rollers when printing on a rotary press. Rubber rollers are sometimes worked with success, as also are composition rollers, but a leather roller is generally used for the purpose. They require a great deal of care to keep them in good condition, and should always be kept soft, but not greasy. In running a metal plate it should always be *gummed when stopped,* and not left standing under the ink rollers, as there is always a little moisture in the rollers that will sometimes injure the plate, which has a tendency to absorb water. It is best, therefore, to always sponge off the plate before starting up the press. Should a plate have a tendency to scum, a weak solution of neutralized nitric acid or a small quantity of gallic or tannic acid with a little gum added to the water in the water fountain will prevent it. There are preparations for accomplishing this purpose manufactured by the makers of the processed plates, and where prepared plates are used it is best to purchase such solutions from them.

When the metal plates are being set and started perhaps the best advice to give the machinist is to be systematic in his working. The morning's start should begin with the oil can. Go over the machine and its working parts yourself. Do not trust an inexperienced boy to attend to this important part of the day's routine. See that oil-holes are clear, and lubricate most those parts of the machine that have the greatest wear. Carry a rag or piece of waste in one hand to mop up any oil that may overflow, and to clean away any dust or dirty oil that may have accumulated.

Examine the ink rollers next, and if any of the skins are loose or baggy, have them rectified at once, and also see that the dampers are in good condition.

When making a start and obtaining register, etc., do not run the same sheets through more than two or three times, less if possible, as this is a frequent cause of work thickening owing to the amount of ink on the sheets being continually pressed upon the clean parts of the plate.

It also causes trouble by transferring some of the ink to the cylinder brush, which afterwards marks the clean paper as it goes through the machine.

Do not fail to gum up and dry the plate if the machine is stopped at any time. The careful observation of this rule will keep the plate in excellent condition and remove one of the sources that cause the work to thicken up.

If, when printing, the plate commences to tint or scum, the machine should be immediately stopped, the plate rolled up in black, chalked and etched. Then add a little magnesia to the ink or a few drops of tannic acid to the damping water.

A little caustic soda solution applied to the edges occasionally will keep them clean and prevent the ink from catching.

The foregoing advice on machine printing will give the beginner the chief lines of treatment necessary in setting and starting plate work.

If the instructions contained therein are carefully followed, there is no reason why the pressman should not produce, at the initial attempt, work in every way equal to his best productions from the litho-stone.

Of all the parts of the press which have an influence on the register, the grippers play the most important part, no matter what kind of a machine is in use. When these parts are not in order, that is to say, when they do not hold the sheets equally fast in all parts, exact register is not possible. Naturally the difficulty is less with small sheets; with larger sheets the grippers come into play more often, and consequently there is more likelihood that an equal number do not come into operation, one or the other of the grippers not holding the sheet so fast as the others. These differences appear still more when the grippers through striking, have become bent. They should not be hammered, as is often resorted to, though if it must be done it should be done only by the most expert manipulator. Equally with the grippers the feed guide should receive attention. Where it is not smooth, or where the edges stand up too high, the sheet is pressed downward, or with paper which is wavy so that it does not lie smooth, the grippers cannot get a good hold without pushing the sheet away. This is a most important point in the effectiveness of the feed guide.

Of the many annoyances associated with the machine printer's task, grit is probably the most troublesome, inasmuch as its presence is almost imperceptible, while its effect is extensive and often disastrous. Its sharp grains become embedded in the inking-roller skins, and plough tiny furrors across the printing forms, doing much damage before the printer realizes the presence of any foreign matter on the inking-rollers. Dust the rollers and examine them carefully before commencing operations, and in this way ensure perfect cleanliness at the start. This may seem a trifle, but "trifles make perfection, and perfection is no trifle," some wise man has said, and by adhering strictly to the rules of care and cleanliness in the handling of metal plates there should be no trouble with grit or other like substances.

At this time the publisher of this book again urges the younger element in the lithographic trade to learn the business from the ground up, not forgetting that lithography, although more than a hundred years old, is in its infancy right now, and is only beginning to take its place in the commercial world. More progress has been made in the past few years than actually took place in the previous century; ignorance and prejudice, to say nothing of the foolish secrecy that prevailed, keeping this beautiful art confined to a narrow sphere. The young man in the trade faces a bright future, if he will devote his time and energies to mastering every detail of the work in hand, and keep abreast of the times. The older men, or at least some of them, will argue forevermore that nothing can ever take the place of the lithographic stone, but they are wrong, sadly wrong, for the metal plate process of lithographic printing has demonstrated beyond peradventure of a doubt that it is a permanency.

In running green paper stock on an offset press there is always more or less trouble to be met with, and while there are many things that will greatly help the pressman to overcome the wrinkles and blurs this class of stock so often causes, the best and only positive cure is to let the paper season before attempting to run. In fact, for close register work there is no other alternative, as green stock is almost certain to stretch in the running, no matter how careful the pressman may be in regard to pressure and water. It will sometimes help, in running this class of paper, to open the end grippers and also drop the gauge pins down a little. Another good way to prevent wrinkles in the stock is to have the packing cut just as small as the printed form will allow; this will remove pressure from the edges of the sheet.

When the sheets stick to the blanket it is a very sure indication that there is too much pressure. Try a little less packing and that will usually end the trouble. In case the blanket has become tacky, change to another and give the one a chance to dry out for a few days. If this cannot be done, wash with kerosene and powder with sulphur. It is here that the patent washes are valuable, as they will go far toward hardening a tacky blanket.

The lithographer has always been more or less troubled by the stretching of the paper during printing. The trouble begins in the transfer room, where it is necessary to use the greatest care in order to make a series of plates that will register; and after this is done, the pressroom is up against the most troublesome proposition met with in the entire trade. The stock has a natural tendency to stretch during printing; besides, each change in the atmosphere affects it. Damp, rainy weather causes it to stretch, while dry weather has the opposite effect.

In the large color houses the pressman does not have near so much trouble as in the smaller shops. For, in the color house, they realize the necessity of keeping the humidity of the pressroom as nearly uniform as possible, and take the greatest care of the stock being run.

It is a good plan in a shop where one is greatly troubled with the stretching of paper, not to make up all the plates for a color job at one time, but rather wait until two or three of the colors have been run, and then, if the sheets have stretched, use one of them for a stick-up for the next color.

When the stretch is not too great, it is possible to help the register to a slight extent by changing the diameters of the cylinders, but when this is done the work will have a tendency to fill up; that greatly spoils the general effect of the job.

If the first color has been run with all the cylinders of the same diameter, the next print may be made larger by putting a sheet around the impression cylinder. On the stone press this plan worked to an advantage, and then it was even possible to greatly aid in taking up side-stretch by running strips of cardboard down the feed board well past the gripper fingers, but this does not give as good results on the offset press.

When the stock has stretched owing to unusual dampness in the atmosphere, it can sometimes be brought back to its original size by racking out in a dry room. The main thing, however, is to use every means to prevent the stock from stretching in the first place. Run color work with the least pressure possible to get a good print, keep the water down to the lowest point, and be careful to get an even flow over the entire plate. If necessary to rack out the work, put waste sheets under and over each pile to keep out the air, otherwise the top and bottom sheets may fail to register. Keep windows closed as much as possible if weather is at all changeable. In fact, use every means to keep the pressroom perfectly dry while on the job, for even apparently under the most favorable conditions it is often impossible to prevent the stock from stretching.

One would naturally suppose that it would be a matter of common knowledge that the general appearance of offset work depends largely upon the finish of the paper used. And yet there are a good many master printers who cannot understand why one job looks so bright, while another has such a dull effect. It is sometimes quite a task to convince them that in all commercial printing it is of the greatest importance that a stock be selected which will meet all the requirements of the design being printed; otherwise the results will not be entirely satisfactory. For example, if the class of work calls for a deep, glossy black, the customer should be impressed with the fact that it will be necessary to use a hard-finished paper in order to get the desired effect. If this cannot be done, or if the customer persists in using a soft-finished stock, the pressman can overcome the difficulty to a certain extent, though at the expense of considerable time and trouble, through mixing certain ingredients with the ink.

When a soft or medium finished stock is used, the ink has a tendency to sink in before it has entirely dried, thus losing some of its strength. Now, in order to keep the solids full strength, and the lighter tones soft and clear, with a thin film of ink, one must prevent the ink from sinking into the paper, which can be accomplished to a limited extent through mixing thick gum in the ink. This is a fairly good remedy on medium runs, but is likely to injure both plate and blanket if the run is more than 5,000. When using gum in the ink, the water in the fountain should be free from etch, as the work will have a tendency to wear away. Gloss varnish is also good for a short run, but is such a quick drier that the ink soon becomes too tacky to lift properly.

Most liquid driers impart a degree of gloss to the ink, but unfortunately the nature of offset printing prevents their use in large enough quantity to really accomplish much good in this direction.

It is rarely necessary to use any large amount of drier in offset ink. Usually a small quantity of bronze blue will be quite sufficient for most black work. However, where a quicker drier is needed, Japan drier works well. The paste driers are also very good, especially in color work, as they dry smooth and flat, and lift the succeeding colors well.

A very good reducer can easily be made for offset ink by taking:

1 part Turpentine.
1 part Kerosene.
3 parts Boiled Linseed Oil.

This will be found to work well on any grade of paper, is a quick drier, and does not affect the strength of the ink if used in moderation.

In running on very soft stock it will often be of great aid in keeping up a good color without picking, if a little kerosene and machine oil are worked into the ink. One should be careful not to get the ink too thin, as it will scum the plate if that happens. Vaseline is also good for taking the tackiness out of the ink. It is always an easy matter to find a remedy for any trouble one is likely to meet with, if a little thought be given to the subject. And it is much more profitable for a person to study out his own problems than to have them solved for him by another.

The pressman should always keep the form rollers in the best possible condition, as the quality of his work will depend largely upon them. The grain should be soft and fine, like a piece of velvet. If the roller becomes flat or full of water marks, the work is bound to suffer. In that case the only thing to do is to sandpaper them until the nap has been fully restored. Where the water streaks are very bad, they can usually be taken out with the sharp edge of a piece of broken glass. The rollers should be greased well, when not in use, to keep them soft and pliable. Either tallow or vaseline is good for this purpose and does not leave the roller too greasy after being scraped out. The skins must be kept tight, as a baggy skin will cause scum.

A great deal of care should be used in breaking in a new set of rollers, as their after usefulness will depend very much upon the pains taken at this stage. To begin with, they should be thoroughly soaked with some oil, such as castor oil. This should be applied as long as the leather will take it up, as it is necessary to get the roller into a condition where it will not be affected by water; otherwise one may be troubled with water streaks later on, and they are very hard to remove, once they have developed. After the oil has had time to penetrate the leather, the rollers should be placed in the press, carefully set, and a good, stiff varnish run on them until all the loose nap has been removed. Then, if the rollers are to be used in color, it is well to run them in yellow for a while, as the first color used will penetrate more than later colors will, and by this means a clean foundation may be established to work other colors on. It is a wise plan to arrange the rollers so that the grain may lie in opposite directions. After the rollers have once been set, they should be numbered at one end to prevent mixing them in washing up.

The smooth rollers do not need so much attention, as they do not come in contact with the plate, and so are not so likely to be injured by the water. In their case a good coat of shellac should be applied. When dry, smooth off with fine sandpaper; then apply a second coat. This can be repeated from time to time, when necessary, and will keep the roller in good condition.

When extreme dryness of the atmosphere is a feature of hot summer days, it gives the offset pressman a great deal of trouble at times, causing the plate to scum if the water is held down to where the ink prints with the best degree of depth and lustre.

The pressman will try many things to overcome this great dryness of the air, but no method is entirely satisfactory; and, aside from this, the very plates themselves, seem more sensitive to the action of the grease in the ink during hot weather. Even after the transferrer has given the plate an unusually strong etch, it will be often found necessary to re-etch one or more times during the run.

Rollers that work perfectly in the winter, often scum in warm weather, especially if there be the least unevenness, or looseness in the cover. At this time one should keep the form rollers in the very best possible condition. Keep up a good soft grain, and don't be afraid to use the sandpaper often. Above all, don't let the skins become too greasy. The dampers should be looked after closely, and it is a good plan to go over them with the water sponge each night, when they are taken from the press. This will prevent them from drying out over night, and will also go a long way toward overcoming any tendency to rot, where the chromic-phosphoric etch is used in the water fountain. In regard to this etch, it is without doubt one of the best agents that can be used to keep the plate clean and is not likely to cause any trouble if handled with proper care. One should strive to work the ink so as to need just as little etch in the water as possible; in fact, if more than 1 oz. to the gallon of water is required to keep the plate clean, something is wrong somewhere, and too much acid is sure to injure the plate if the run is a very long one.

In running heavy solids, a little gum worked well into the ink will help keep the plate clean, but one should be very careful in this, as too much gum will cause more trouble than it will remedy.

The biphospate and nitrate of ammonium etch is very good for warm weather, and a good many prefer it at all times. This etch is fine for clearing up work that has thickened up on the plate. Just saturate a sponge with the etch and a little water; go lightly over the plate, taking care to wash off at once; gum up and dry the plate. Gum in the water will sometimes help in keeping the plate clean, but as it dries on the blanket, it is liable to cause trouble. Glycerine will be of some help in keeping the plate damp, if one is careful to keep it out of the ink rollers.

To sum up the whole matter, one should keep up a good grain on the form rollers, keep the skins stretched down smooth and tight; keep out all water-streaks or other unevenness, and be sure not to let the rollers get too greasy. Wash out with turpentine or benzine now and then, if necessary to remove the surplus grease. Work the ink stiff as possible; reduce with No. 00 varnish and japan driers. If working a soft paper that picks, add a little kerosene to shorten the ink. Keep the water fresh in the fountain; use between ½ and 1 oz. of etch to the gallon of water, and keep the dampers soft and free from hard spots; keep brass roller clean—go over it with a little etch now and then. When these precautions are taken, one will reduce the probability of scum to the lowest point.

Owing to the methods used in preparing photographic plates, the pressman will find them very sensitive to the action of grease, and it is best to be careful, in starting up, to see that the dampers are in good working condition, and dampening the plate evenly over its entire surface, before lowering the ink rollers, for, if these plates once catch up, or the work becomes thick, it is a very difficult matter to get them in good condition again. Transferred plates give less trouble in this direction than photo plates; but, on the other hand, they are much more easily spoiled through the over-use of etch in the water. The pressman who is not familiar with both classes of plates should watch his work carefully and keep these points well in mind.

While the difficulties attendant upon printing in black, for strictly commercial work, such as checks, letter heads, and insurance forms, may be less in some respects than on color work, still, in many ways, a good commercial printer has to be more careful than the color man. It is not always an easy matter to get the work to stand out sharp and clear, with a full depth of color; and quite often much time is required to remove all the dirt and spots that are left on the plate through careless transferring. The sheet should be gone over to see that every line is printing properly before going ahead with the run, for an error over-looked at this stage is seldom seen after the run begins, when there are so many other things to require the pressman's attention. Most mistakes as well as accidents are caused through carelessness, and one should cultivate careful habits, even at the expense of speed, for practice will be sure to bring speed in time; but great care only comes through constant striving. To become a really expert pressman, one should be "on the job" from start to finish and take no chances; but when a thing needs fixing, fix it at once, for delays are dangerous.

The ink for commercial work must be of the very best quality consistent with the class of work being done, and so worked as to produce the best possible results. And now that there is so much talk of offset work being the equal of steel plate printing, the pressman who would produce such results must be very efficient indeed. Still, steel plate printing is a fair mark to aim at, and though one may fall short in producing the same results, yet when the high rate of speed and general cheapness of the offset process is taken into consideration, it must be admitted that wonders have been accomplished along this line, and that the future is indeed promising.

One great advantage the commercial pressman has, is that the stock used on this class of work is generally, though not always, of a very good quality, and another is, that he is seldom required to get a hair line register. These are great advantages to him and go far towards making life bearable, as there is nothing more trying to the nerves than attempting to register colors when the paper has stretched.

In working a good black, one should reduce it in such a manner as to retain all the brightness and density possible with a free lifting ink. And it is well to bear in mind that it is not so much how the sheet looks when fresh from press, but how it will look next day. Very often a job will look fine when printing, but after the ink has dried into the paper and some of the oils have evaporated, the work is dull and faded out to such an extent as to be very disappointing to all concerned.

The best way to prevent the trouble is to select a reducer that will not penetrate too far beneath the surface of the paper; the idea being that the ink should just take a firm hold on the paper, then gloss over on the surface and dry. The stronger varnishes have this quality to a very marked degree when worked with a good drier, but unfortunately for the printer, they are not suited for offset work except in very rare instances, and on short runs. In fact, the ideal reducer has not yet been put upon the market, though there are several that work very well under most conditions, and only fall short in exceptional cases.

Most pressmen prefer to experiment with reducers of their own compounding, and it is not a bad idea either, as working conditions vary in different localities, and what works well in one shop does not always do so well in another. The main idea is to get the ink to dry with the least possible loss of strength and luster, and whatever ink does this will be the right thing to use. Most of the more volatile oils that work best in the ink, cause it to dry too soft and flat to prove entirely satisfactory; yet the general effect produced by them is far from displeasing, and is really preferred by many customers.

In summing up on this reducer proposition for commercial ink, one must consider the design being reproduced, the stock used, and the effect desired. Having settled these points, then decide how best to reach the end aimed at, if that should be a soft, quiet effect, then use a reducer that will dry out smooth, flat, and slow. Most of the oils and fatty substances have this characteristic. Kerosene, boiled oil, vaseline and the like, are all good in this direction.

If a glossy effect is desired, it will be necessary to use a reducer containing varnish in some form or another, adding a certain amount of drier to cause the ink to dry out quickly.

In color printing the reducers give less trouble in some respects than in commercial work, as here a soft smooth drier is usually required, and the oils that work best in the ink are the same that have this effect. One thing to be careful about, however, is not to get the ink too short; for, though it will print fine that way, it will rub after drying if the stock is at all smooth. It is a good rule to run the first three or four colors with little or no drier at all, after that add just enough to be sure that the colors will all dry thoroughly with the last printing. Yellow and blue, and inks containing either of these, usually dry very quickly; in fact, it is sometimes necessary to retard their drying. The first colors must dry soft, so that each succeeding color may lift freely and so avoid any glossy spots when colors overlap in printing; yet, on the other hand, the printed colors must be dry enough not to offset back upon the blanket nor to rub.

When cold weather comes we can begin to expect the usual amount of trouble from electricity in the stock during printing. This trouble is all the more aggravating to the careful pressman from the fact that it can be so easily controlled by the proper equipment for the pressroom.

If it was possible at all times to maintain the same temperature in the stockroom and the pressroom, and all paper could be kept on hand long enough to enable it to adapt itself to the atmosphere of the stockroom, there would be little or no trouble caused through electricity. But this is not always possible with the present condition of the paper market, and so the pressman has to worry along the best he can. It will be of some help if the stock is sent to the pressroom a few days ahead of time,so that it can be opened up and, if possible, racked out or hung up. There are also a few other simple stunts that will help, if conditions are not too bad, such as dampening the outside wrapper of stock before it is opened up and piling wet cloths around the delivery board.

If one wants to experiment with a home-made neutralizer, a very fair one, that will work under some conditions, can be made of a piece of gas pipe with holes at regular intervals of about one and one-half inches. Attach this to the gas supply and place across the press so that each sheet must pass directly over it as it comes from the press. The pipe should be covered over with a piece of sheet iron to protect the paper from the gas flame. This device will be found to work in a great many cases, but there is always some danger of the paper catching fire in case of a choke-up. I do not know whether this idea has ever been covered by a patent or not, but it would be well to look into the matter before using it.

Another and much better home-made device, where steam heat is used, is to attach a perforated pipe to the steam coil, place this pipe just back of the delivery reels and spray the sheets with a fine film of steam. This will work well under almost all conditions and will prove a great help in keeping the paper straight in the jogger. Of course, all these substitutes are unsatisfactory at times, otherwise the more perfect machine would not be on the market, but when a policy of rigid economy is in force, the pressroom will often have to resort to almost any plan that seems to promise relief.

The offset press, like all other improvements, created a new condition in the printing trade that called for certain changes in the viewpoint of the front office, and those who have been quickest to appreciate this fact, have been the ones to meet with the most success in this branch of lithography. A few concerns have failed to make this department profitable, but it has usually been owing to lack of judgment on their part, through which they have been led to expect the impossible. Having no practical knowledge of lithography, they assumed that if a press was guaranteed to run at the rate of 5,000 an hour, that would make 40,000 impressions a day's work. Of course, the lithographer who was familiar with flatbed and rotary presses knew there would be much time lost on the offset, due to stopping to work on the plate, to clean the blanket, and other causes. Hence he never made the mistake of figuring his press work on a basis of 5,000 an hour. Some others have been disappointed because they put too much faith in the tales told them by the press salesmen; as, for instance, that almost any bright young man in the pressroom could run the offset without any previous training, and that the less he knew about lithography the better he would get on. But now that the offset has been in successful operation for several years, all these mistakes are things that are past, and the firms operating offset presses now know just what their output will be on any given class of work, and can make prices that will give a profit. With apologies for this digression we will get back to the pressroom.

The pressman is not always to blame when a job turns out to be rather unsatisfactory, for sometimes the failure may be due to causes over which he had no possible control; and this fact has led to some thoughts along this line that may prove of some value to others. Take for instance some of the flat work we see at times, usually one would say the pressman had not regulated ink and water properly, or was running with too much pressure. But there are other causes that may be responsible for this effect. And even though the transferrer can roll up the plate so that it seems right to an unpracticed eye, it must be remembered that in printing a great deal more ink will be applied to the plate than it will take from the hand roller. Then, again, generally speaking, a plate will print somewhat thicker than the work actually appears on the plate, since the softness of the rubber blanket must tend to spread the lines to some extent. This cannot be prevented by the pressman, for the simple reason that there must be some spring to the rubber; otherwise it would not readily take the impression from the plate nor impart it to the paper. The engraver should take this into consideration in executing work for the offset. In fact, the commercial designer should study out just what the effect is likely to be, when his design is reproduced by this process. He should understand what the possibilities are, and above all, know something of its limitations. Otherwise he may strive for effects that cannot be obtained. It is just as well to remember that the pressman cannot get the same effect in one printing that the designer gets through the use of a full color on the solids and a wash for the background and shading. This can be approximated through the use of a fine ruling, but will not be exactly the same. And while this is true in black work, it applies with even greater force when colors are called for. Every pressman, and engraver, too, for that matter, knows what it is to be called upon to reproduce in one printing, a sketch that really calls for two or three, and the disappointing results usually obtained.

As already stated, the engraver should not forget that while the offset will print the most delicate lines, it has the fault of spreading the work to a microscopic extent that causes the ruling to print a little heavier than it is on the plate. Hence, it is a safe plan to space the ruling a little wider than for stone printing. These points are now generally recognized by all engravers, but there was a time, not so far back, when this caused a great deal of friction between press and transfer rooms. As the pressman was naturally inclined to place the blame for thick, muddy printing upon the man who made the plates, while the transferrer took the ground that if the plate rolled up clear, the pressman should be able to get a sharp impression.

On the stone press it was customary for the pressman to keep a good hand roller, and roll up and etch the transfers whenever the class of paper or condition of the ink might require such treatment. But this cannot be done so readily on the offset, nor is the result so good when it is done. Sometimes it will help to lighten up a heavy plate by washing it out with turpentine and water, giving it a slight rub up, however, before starting the press, just as if it were a stone transfer. One might also try rubbing the work down with the gum sponge; then dry the plate. This will often help when the ruling is just a trifle too strong.

The pressroom is always in more or less trouble from stretching and creasing of green stock, and as faster machines are installed, that require a larger supply of paper for the day's run, the trouble with the stock is more likely to increase than otherwise. It is all very well to say that, if the mills would do this or that, or if the purchasing agent would only buy well-seasoned stock, things would be different. But the buyer is confronted with the fact, that with many paper mills behind with their orders, and the demand for paper increasing all the time, there is no chance to secure well-seasoned stock on any terms. Formerly, when long runs were the exception rather than the rule, in the smaller shops, it was customary to carry enough seasoned stock on hand to take care of almost any order that might come in. But in these days it is often straight from the mill to the press, and the result is more than likely to be creased sheets and faulty register. This can be overcome to some extent, where there is a chance to hang the stock in a dry room.

Stretching of the stock is one of the most difficult things the pressman has to overcome, and where color printing is done, the pressroom should be kept at the same temperature night and day. In the Geologic Survey at Washington, where they have to keep perfect register on official map work, the stock and pressrooms are kept at the same temperature and the same degree of humidity night and day. Other shops could do the same thing and some of the larger ones do so; but most plants go on the theory that the pressman will get away with the trouble somehow or other; so why worry?

Dry Lithography

THERE has recently come into vogue in the lithographic business a process that is known as "Dry Lithography," which consists of printing in the lithographic manner from a metal plate on an offset press without the use of damping rollers. In order to do this the printing plate must be etched in relief. Do not try to etch the plate too deeply, however. A comparatively light etching is all that is necessary. The object is to have the printing surface high enough so that the ink roller will not touch the blank spaces between the words or images to be reproduced. The printing plate must be entirely covered by the work to be produced, otherwise the white or "highlight" places will catch up and print. A rubber or composition roller will be the best for an ink roller in working dry lithography, and the ink must be run very lightly.

The work that has been the most successfully done by this process so far has been tints and back grounds for bank checks and similar work. Here the entire surface of the paper is printed, and no white spaces are left for the roller to get into and cause the blank spaces to print.

By this process fugitive inks may be used, as no water comes into contact with them while the press is running. Analine colors that it would be impssible to use with a damping roller may be printed by "dry lithography" very successfully, and many sheets of so called "safety paper" are thus made. Checks printed by this process produce the limit of safety from alteration, because water, acid or any liquid substance that touches the ink, immediately causes it to "run" and thus betrays the alteration. So far dry lithography has not gone beyond the check tint to any great extent but there are many different kinds of work that might be printed by the dry process successfully. Many ink makers are now making and advertising fugitive inks for dry lithography and any of them may be used to advantage by the lithographer who is trying out the new process.

PHOTO LITHOGRAPHY

Up to Date Manner of Preparing Plates for the Offset Press

WHILE the pressroom end of the lithographic plant has been rapidly taking on new life by the adoption of the Offset Press, the other end of the shop—engraving and transferring—has not been idle by any means, as the wonderful strides made by photo-lithography can testify. Like the metal plate and the offset press, photo-lithography is just beginning to come into its own, and unless all signs fail, the time is not far distant when all, or nearly all, the plates used on offset presses will be prepared by the photo-lithographic process.

As a matter of fact the use of the camera in lithography has developed so rapidly of late that its possibilities are almost inconceivable. Among other developments is a set of machines which, used in connection with the camera, enables a lithographer to take an oil painting, or almost any other kind of copy, and in an incredibly short space of time separate the colors, reduce or enlarge the size and put them down on plates ready for the offset press. Not only that but he can repeat the subject any number of times at a remarkably small cost, and when the plates are ready for the press they will be in better condition than it is possible to obtain by hand work. This particular machine, or set of machines, has been adopted and installed in several of the larger shops of the country and the process has been declared a great success both from an artistic and a commercial standpoint.

Other processes or devices have been brought forward in the lithographic trade, and some of them have proved successful in every respect and they are bound to prove a benefit to the trade of the future. In each and every case these processes are photo-lithographic and are destined to be used in connection with the offset press.

Photography was not discovered by any one person, but was evolved by many minds. Through the revelation of Mungo Pouton, in 1839, that chromic acid is extremely sensitive to light; through the disclosure that chromic gelatine becomes insoluble in warm water, by Talbot; and, finally, by the adaptation of these principles to pigment, carbon and photo-lithography by Poitevin, a new field was opened up to graphic endeavor; the screen process being its highest realization on the printing press, and fully incorporated in lithographic methods today. The unexcelled principle of the litho-transfer, the extreme fineness of the Benday film, the introduction of metal plates, self-feeding machinery, the rubber blanket offset, rapid printing presses; in short, the host of mechanical and chemical devices open to lithography, form a constantly growing galaxy adding new triumphs to the art.

Lithography, it can be truly said, is mistress of all processes, because it is the method, par-excellence, of the combined mechano-chemical processes, finding its fullest, most far reaching and economical exemplification in its versatile methods as practiced to-day.

Through the advent of photography and the immense flood of light which it shed upon the reproduction and development of art, lithography was at once projected as the one method capable to participate most prominently with, and maintain her dignity toward all; for instead of losing prestige, lithography blossomed out in new array, in rich colors, and at present stands unexcelled as the queen of chromatic reproductive methods; artistically potent and commercially capable, she is the central figure upon the grand dome spanning the glorious structure of the graphic arts to-day.

Imitation of the marvelous color displays of nature by the camera is the goal of photo-lithographers, and the camera now has the same power as the human eye —it can not only see, but it can reproduce color—and through it the lithographic trade will multiply its productions and extend its importance as an educator of the masses. Soon it may not depend upon the translation of brush and palette to gather the secrets from the garden of Mother Nature. Upon this little globe of ours, floating in infinite space, the lithographic employer, as well as the lithographic employee, has become really an intellectual being, constantly setting before the public gaze the highest examples of art and striving to teach ideal color-culture as rendered in the grand displays of nature.

The progress of chromatics will not cease. It has been planted in the human soul and is essentially for the advancement and progress of coming ages. The lithographic art is emerging from the confusion of mingled colors, when registering marks were pulled apart, plates began to tint, streaks began to appear, and even solids walked right off the surface, and the progress being made, cannot be checked by the little men of the planet who always oppose things new and novel.

One of the most successful and beautiful photo-litho processes before the public at present, is that adopted by Frey, of Zurich. The sketch or other object to be reproduced is photographed through color filters, using a color-sensitive gelatine or collodion emulsion plate which when properly developed gives a color-selected negative for printing onto a metal plate coated with an asphaltum film. This specially prepared asphaltum film after exposure to the light is developed with a suitable solvent when minute particles of asphaltum wash away, and leave the tones of the picture broken up with an exceedingly fine irregular grain. In most cases three negatives are made, using three color filters to reproduce the three fundamental primary colors, commonly known as yellow, red and blue, and from these three negatives are produced the number of color-printing plates necessary for working the design. The various color strengths are gotten by under and over developing. For instance, a pink or flesh tint would be obtained by under developing a print from a red negative, supplemented by a fair amount of work put on by the litho artist, such as filling in solids and taking away the high lights. The impressions from this process are very fine, and, as works of art, bring good prices.

The question is often asked by many lithographers: Has not the camera in lithography driven out the artist element in the trade? In answer we say most emphatically, No. The chromo-optical process of making pictures has been nothing but a valuable acquisition to commercial lithography and has hurt no one. We need only to compare the results produced by that class of lithography twenty years ago, with that turned out to-day, and we will find where fifteen colors were used then, seven or less are used now, with the same effect. Naturally, in order to obtain this economic advantage the technical part of the work had to advance 50 per cent; so we find at present the work must be finer and closer, the textures must be more marked and diverse, the work more accurate, and at the same time it must be truer to nature. Photography and process have forced the lithographer to advance likewise in his Benday, crayon or stipple work. So that instead of shedding a baneful influence upon the lithographic art, it has certainly benefited every one even remotely connected with the lithographic trade. It has educated the mind and eye of artist and public, as well as accelerated the dexterity of the lithographer's hand—in other words, the graphic arts would have retrograded if it had not been for photography.

For practical purposes the photo-litho process may be classified according to the two chief methods:

1. The first, in which the plate or stone is coated with the light sensitive photographic substance and exposed under a reversed negative, so that a reversed image is formed on the stone or plate which, in printing, comes in the right position.

2. The other, in which paper or a very thin zinc plate, provided with a light sensitive film, is exposed under an ordinary—that is, not reversed—negative, and thus is rendered capable of receiving fatty ink and is then transferred to the plate or stone by transfers.

The basis for the photo-litho is generally a photographic negative on glass or a gelatinous substance which, as the word negative implies, when examined by transmitted light, must have all its tones reversed. That is to say, to be specific, the drawing, lines, strokes or points, which are to be black in the print, must look transparent, while the other part of the negative which forms the ground work must be covered or opaque.

Of the many processes, Fritz, the Viennese authority, says, though differing in detail, they may all be assigned to one of the above-mentioned principles. However that may be, there are two which have been especially tested in practice, namely, for the direct transfer, as we will call it, that process which is based on the light-sensitiveness of asphalt or of an organic substance in combination with a chromium salt; and for the indirect transfer that process which is founded on the light-sensitive chromium salt in combination with gelatine, or briefly on the light-sensitiveness of chromated gelatine. All other more or less complicated methods have disappeared from technical practice and have now only the honor of being scientifically and theoretically correct, but for various reasons are not practically valuable.

Until quite recently the direct process in its application to the lithographic stone or plate was uncertain in its results. It was impossible to secure sufficiently close contact between the negative and the stone or plate, particularly when large surfaces were under operation, and consequently the prints were seldom a complete success. But the successful application of the direct process to modern zinc and aluminum plates is now an accomplished fact. The metal plate is sufficiently elastic to adapt itself to any inequalities on the surface of the negative. Under such conditions as these this process offers at least one very important advantage—there is not the slightest possibility of distortion, such as might occur in the development of the transfer.

The methods used by some experimentalists for direct transfers, which began by coating the stone with a solution of gelatine, albumen, or gum made light-sensitive with a chromium salt, and after exposure under a positive or negative, obtaining a printing plate, were complicated and troublesome, but the results were fairly safe and they are now more and more used in practice.

Photo-lithography in lines is simply the reproduction of line drawings or prints in which the design is represented in black and white with such gradations that may be suggested by lines or dots. Half-tone photo-lithography is the reproduction of a design or copy which has in its composition gradation of tone in the form of flat tints. This is sometimes described as the translation of the graduated light and shade of the original copy into a surface which can be printed from by mechanical means, for which purpose the ink-bearing surface is broken up into the most minute sections, thus forming an almost imperceptible grain. The first attempt to reproduce the half-tone of a copy, in the form of a grain consisting of minute dots, was made with a screen of open textile fabric. This was done by placing the screen between the lens and sensitive plate but the results were crude and unsatisfactory. It had the effect, however, of stimulating interest, and the invention of cross-line screens soon followed. In this latter method lines were cut on glass and filled with suitable coloring matter and it was at once recognized as a decided advancement in half-tone photo process. The screen effect, is even now a drawback to its more extensive adoption, as fine etching cannot be resorted to as in photo-engraving. There are no insurmountable obstacles, however, to hinder the production of excellent transfers, as this effect has to some extent been overcome by the use of a four-line screen in lieu of the usually crossed screen, while more recently a higher degree of excellence in photo process work has been attained by the adoption of a natural grain, which is undoubtedly based upon collotype methods in which reticulated grain is produced more or less suitable for lithographic printing. Unlike the mechanical screen grain, the texture of this process reproduces the original copy with but little, if any, loss of expressive power. There is still much to achieve in photo-lithography, and it is probably more owing to a full recognition of this fact that the progressive character of the process is maintained. Its commercial value is undoubted, and its successful application is chiefly a question of how and where it can be most effectively introduced.

A photo print can now be made direct on either zinc or aluminum plates and, by a slight modification of the photo-engraving process, can be developed according to lithographic methods. In a direct photo print on metal, the finer qualities of the work are much more likely to be retained than when a transfer print is made under the negative and afterwards transferred in the usual manner.

One authority says, in discussing photo-lithography as applied to metal plates, that the plate should be finely grained and then coated with sensitized asphalt solution and exposed under a negative for about five minutes in direct sunlight and about twelve minutes in a diffused light. The action of light on the asphalt solution is to render it insoluable in turpentine, so that if a sufficiently exposed plate is immersed in pure turpentine the lines, etc., of the design, being of course represented by clear lines in the negative, will remain intact, while the surrounding portions will be dissolved and washed away. After development, wash the plate freely in water, and dry it by fanning or using a pair of bellows. Let it stand for about ten minutes and then slightly etch it with a very weak solution of nitric acid. Cover the work with strong fresh gum and dry it thoroughly and quickly. Remove the gum and rub up the design with black ink in the usual way, wash dry and dust over with French chalk. Every maker of metal plates supplies this special etching solution prepared for a certain quality and character of metal.

Pen and ink sketches and wash drawings are entirely under the control of the artist and characteristic effects are chiefly due to bold and vigorous conception and skillful drawing. Scraper boards offer most remarkable possibilities for black and white half-tone sketches. This consists of a light wood pulp board with a convenient base upon which a thick coating of white composition is laid. Black ruled lines are printed on this surface and lines of similar texture are embossed at right angles to them. Drawings in pen and ink may be effectively handled by free and skillful use of the scraper. Embossed lines only are the peculiar features of these boards, but variety of texture can be obtained by scraping these lines into dots.

According to the existing technique of photo-lithography and the almost perfect state of the transfer process, anything can be reproduced by this method. It rests in all its branches of application on so simple a principle, that any lithographic printer with a little practice and observation, can attain absolutely good results.

Before the discovery of the method of breaking up half-tones into points or dots, only line drawings could be re-produced by photo-lithography. Since it has been possible to break up half-tones nothing stands in the way of reproducing by this method any kind of original.

The negative for photo-lithographic work must before all things possess two principal qualities: when looked through it should be as clear and as clean as possible; on the other hand the ground as well covered as possible. The deposit should be of black color; but from a well drawn original, absolutely satisfactory negatives can be prepared without the black color. When a drawing is reduced which contains gray lines, dots, and points, as well as full black ones, toned lines will be visible as well as the transparent; with careful treatment, the negative may be so far corrected that it may be used. If this is not effected, or is not possible, the retouching may be somewhat troublesome.

It will not perhaps be out of place to give here accounts of photo-lithographic methods that have recently been adopted by some of the leading lithographers who are at present turning out beautiful work by means of the camera and metal plates. Their method for obtaining intaglio plates is processed by first etching the original print into slight relief and then reversing it. Another process, which is similar to the latest half-tone processes, is based upon the use of an asphalt solution to give the necessary grain.

The sensitizing solution most generally used for metal photo-lithographing is prepared as follows: Take water, 1,000 parts; bichromate of ammonia, 3 parts; albumen of eggs, 100 parts and little ammonia to color the solution to a light yellow.

This solution should be filtered with care and should then be flowed over a properly prepared plate, whirled over gentle heat until the coating is evenly spread over the surface and has become dry. It is then exposed to the light under a positive, after which, the exposure being judged sufficient, the metal is taken out of the frame and inked with a roller charged with transfer ink that has been reduced with turpentine. The plate now appears gray without any sign of the picture. The ink must not be black, but rather thin and evenly coated.

By immersing the plate in luke-warm water, the design will shortly appear. A little aid to the development can be given by the use of a small piece of raw cotton, which should be rubbed gently over the plate until the design is clear and sharp.

The image so obtained is a negative one, and the metal is bared at the points representing the black in the original. The albumen has, in fact, remained soluble at these parts, having been protected by the corresponding lines in the positive when exposed to light in the photographic frame.

The plate is then rinsed with plenty of water, dried, and plunged into a solution of perchloride of iron at about 35 degrees F, in which it should remain from ten to fifteen seconds. It is then washed again and dried. Upon again passing over the plate which has been slightly heated, a roller charged with transfer ink, the ink adheres over the whole surface. A black picture is thus made, after which the deep parts are brought out by the aid of a smooth roller passed rapidly over the surface of the plate a few times. The picture is again developed by rubbing the surface of the plate with a piece of muslin that has been soaked in caustic ammonia. The design will now appear reversed, the image being in black, standing out from a brilliant background formed by the metal. During this operation the bichromated albumen, made insoluble by the light, dissolves in its turn in the ammonia, and a second development is thus operated.

By the rubbing, and the aid of the ammonia, the ink is removed from the parts at which the insoluble albumen is prominent, while the ink remains upon the perchloride of iron. The plate is now prepared in the ordinary way for lithographic printing, rolled up, chalked, and etched.

The metal plates used for this purpose are first well cleaned with benzine to remove all traces of grease. They are then coated with a solution of asphalt, using a whirler to obtain an even coating. When this is properly accomplished, the plates will have a golden appearance, and are then ready for printing upon through the negative. The necessary time for exposure in sunlight is about four minutes, and about twelve minutes in diffused north light, between 10 a. m. and 2 p. m. The thicker the film, the longer the exposure.

The photo-printing frame must be of strong construction, with a pad of thick felt placed behind the plate to insure perfect contact.

After the exposure the plate is developed in a zinc dish, with French or Neustadt oil of turpentine. Development is rapid, and usually takes from one to two minutes. In developing over-printed metal plates, an addition of Russian turpentine is of great assistance.

After development the plate is well washed and whirled to free it from water, and it is then dried in the sun for about a quarter of an hour.

It is then etched in a one per cent. solution of nitric acid; leave in the bath for about one minute, wash with plenty of water, drain, gum up, and dry quickly.

The plate is allowed to stand for fifteen minutes, and then the gum is washed off and the plate is inked up with a soft ink. If the asphalt design does not take the ink freely, resort must be made to the rubbing-up rag charged with the ink and a little grease (such as palm oil) if necessary.

When inked-in satisfactorily, wash the plate with water, dry quickly, and dust over with French chalk. The plate is then etched with the usual etching solutions, gummed up, and dried.

It can then be washed out with oil of turpentine—without removing the gum coating—inked in solid, and rolled until clear by adding a few drops of water; then gum up and dry.

Allow the plate to rest for fully an hour, so as to allow the work to become set upon the metal. At the end of that time the plate is ready for printing.

If the plate is not accurately treated, it will scum in the rolling-up, and give dirty impressions. When such is the case, roll up the design, dry, French chalk, and etch with a weak solution of acetic acid; then rinse well.

In printing from machine it is advantageous to add a small quantity of glycerine to the damping water.

When it is found necessary to make alterations or additions to metal plates already in use, they should be well rolled up and French-chalked. If any parts of the design are to be erased, wash out those parts with turpentine or benzine. Wipe perfectly dry and apply a small quantity of caustic soda solution to the plate by the aid of a camel-hair brush. When it is apparent that all trace of grease is removed, wash the plate, and then repeat the operation to make sure of its cleanliness.

After this, run over the plate a solution of citric acid, wash well with plenty of water, and dry quickly. It is then ready for the new work to be transferred or drawn upon it. After the alterations are completed, gum up the plate thoroughly, fan dry, and proceed as before described.

Still another process that may be used for photographing direct on the plate or stone embraces the principle of printing on light-sensitive asphalt or an organic substance in combination with a bichromate salt. This light-sensitive asphalt, or so-called Syrian asphalt, which is prepared for photo-lithographic purposes, can be obtained from various firms who deal in photographic goods. Only that part of the asphalt is sensitive for photo-lithographic work which does not dissolve in ether. The insensitive part must, therefore, be separated out, which is done by finely powdering the asphalt, sifting it through a fine sieve, then treating it with ether. All that is soluble in ether goes into solution; the marc which is not soluble in ether is then dissolved in benzole and used as wanted.

Professor Husnik has improved this process insofar that he does not dissolve the asphalt powder in ether, as, according to his view, a complete solution of all the insensitive portion is not attained by this process, but he dissolves coarse asphalt powder completely in rectified spirit of turpentine to the consistency of a moderately thick syrupy mass, until no hard particles or a residue are contained in the solution. To this viscous asphalt solution a plentiful quantity of ether is added gradually, and with constant stirring; and a large bottle should be used for this purpose. After a sufficient quantity of ether has been added a pitch-like deposit separates out at the bottom. In order to test whether there is still any light sensitive asphalt in the supernatant liquor a small quantity is poured into a glass and mixed with ether, when if a precipitate ensues, more ether must be added to the large bottle. After standing for about twenty-four hours the ether contains all soluble insensitive constituents of the asphalt, the pitch-like residue in the bottle, after pouring off the solution is again treated with ether, so that all turpentine is extracted and any stray and sensitive particles are dissolved. The pitchy residue is now removed from the bottle and allowed to stand in a porcelain dish in a warm place, with frequent stirring, till it is quite free from ether, and has formed a hard, brittle, black shining substance, which can be easily broken up into powder with the hand. This product is now the light-sensitive asphalt, which is dissolved for use in anhydrous benzole. As benzole is only to be obtained anhydrous with difficulty, some chloroform is added to the solution to prevent the running together in drying, in which case the film would become unequal and patchy. The coating of the plate or stone with the asphalt film is very simple; it should be placed horizontal, then whirled rapidly on a whirler. The picture is developed with turpentine in following out this process.

Many lithographers are accustomed (and indeed, it is necessary with some transfers) to rub the prints up with greasy ink. This process is as follows: Greasy transfer ink is diluted with some turpentine, and after the stone or plate has been gummed and allowed to dry and then washed, the drawing is wiped over with a soft pad saturated with the dilute ink; the ink adheres to the drawing, which strengthens it. If great care is not taken in this process it will also thicken the work.

With asphalt prints this method is absolutely unnecessary and for other direct prints, as well also as for good chromated gelatine prints, this practice is useless. The exposed asphalt combines so intimately with the plate that strengthening with greasy ink is quite superfluous; is, indeed, absolutely purposeless, as the ink can neither penetrate the hard asphalt film nor combine with it. The film of asphalt alone is so resistant to every etching solution that it is for this reason entirely useless to strengthen it.

In making half-tones for the offset press an entirely different method is adopted from the same kind of a plate for the type press. In fact such fine work is being done from half-tones on the offset press that some photo-engravers are beginning to make plates especially for that process. This is done by working direct, thereby avoiding the necessity of reversing the transfers.

The photo-engraver, in making a half-tone plate for the type printer, reverses it in the process of preparation by stripping the film from the plate of the camera, turning it over and laying it face down, causing the lettering to come out on the plate reversed and when it comes out on the printed sheet, it of course appears properly. In making a plate for the offset press this reversing process is omitted, the reversing being done naturally when the transferrer puts down the transfer on the metal plate.

A capable transferrer need have no trouble if he will be particular to use none but first-class transfer paper in the work of reversing. Poor, old transfer paper causes more trouble in the shop where the offset press is used than any other thing which enters into the work. In case he is called upon to make a photo-lithographic transfer the transferrer should remember that this transfer paper is a specific article in every respect, the coating of which consists of a gelatinous emulsion, which can be readily sensitized, and upon which a photographic image can be developed. A bichromated, gelatine paper can be obtained by coating a hard writing paper of medium thickness with a gelatinous solution consisting of one ounce of gelatine and one ounce of water, and afterwards sensitized with bichromate of potassium. It is better to use the commercial varieties of paper and sensitize it as required. The sensitizing solution can be prepared by dissolving one ounce of bichromate of potassium in 20 fluid ounces of water. Add to this sufficient ammonia to give it a bright orange color. Keep this solution in a temperature of about 60 degrees Fahr., and float the paper on it for about one minute. Pin or clip the paper to a board or squeeze it to a glass and dry in a dark room.

Correct exposure and sufficient illumination of the copy are always important factors in photographic reproductions of any kind, but they are of infinitely greater importance when applied to photo-process reproduction. One is, to a certain extent, dependent upon the other. The former must of necessity be controlled by the latter; yet no amount of exposure will compensate for defective illumination. Where artificial light is employed the advantage of using two lights is obviously great. Apart from the greater brilliancy and intensity of the light the illumination of the copy is more evenly distributed. In scraper-board copies no shadows are thrown from the embossed dots or lines, and the granular texture of grained papers is entirely eliminated.

The original for reproduction must be on the same optical plane as the sensitive plate in the camera; that is, they must be on the same parallel.

One of the latest inventions calculated to improve photo-lithography is a French process by which the inventor affirms that he can give results which are perfect as to gradation of tint and fineness of modeling, reproducing with the greatest fidelity all the detail and tone of the photographic negative. The surface of the stone or plate is first finely grained by the methods ordinarily employed in lithography, and it is important to obtain a grain of absolute uniformity and regularity. After the graining there is a process of cleaning up by means of a weak solution of nitric acid, and the surface is then rapidly dried. It is then slightly warmed, and the surface thinly covered with a preliminary coating of gelatine, the stone or plate being then maintained at a temperature of forty degrees centigrade, or one hundred and four degrees Fahrenheit, until completely dry. A solution of albumen, twenty parts, saccharic acid, ten parts, to water two hundred parts, is then applied over the substratum of gelatine and dried. Two other solutions are then prepared: first chrysaniline, 2 grammes; chloride of zinc, 50 grammes, and water 100 c. c. The second solution is made up of bichromate of potash, 14 grammes; bichromate of ammonia, 30 grammes, to water 1,000 c. c. For use in mixture equal parts of the two solutions are taken, and this is flowed over the stone or plate, which is then raised to a vertical position to allow the excess of the solution to drain off. When the coating is dry, the exposure is made under a photographic negative; in a good light of normal intensity the exposure varies from ten to fifteen minutes. A special ink is made for rolling up, consisting of convenient proportions of lamp-black, venice turpentine, and black writing ink, mixed while made hot, and to which is also added a paste composed of bitumen and resin powdered very fine, and beef fat. This ink is well distributed with a hard roller, and the surface of the stone or plate well rolled with it all over. The image is developed by passing very lightly over the surface a sponge saturated with water. When the print has been developed clean, the stone or plate is then well gummed and dried. The surface is sponged over to remove the gum, the ink cleaned off with turpentine, and the work is then etched with a weak solution of nitric acid for removing the sensitive film. It is to be remarked that with this process the photographic image is applied direct, the coating which has served for sensitizing being destroyed by the application of nitric acid before the last inking. The method is said to be excellent for the perfect reproduction on stone and metal of photographs from nature, pen and ink designs, water colors, etchings, etc., and can be applied with success to three or four-color work.

Occasionally it is necessary to intensify a dry-plate negative; the following mercury bichloride solution with silver cyanide blackener is as good as anything for that purpose. Of course, this combination is intensely poisonous and care should be used in the handling:

Mercury Bleach Formula—Dissolve one ounce of mercury bichloride in thirty-two ounces of hot water. When the solution is cool, carefully decant it so as not to disturb the little sediment at the bottom. Now add to the decanted solution about half an ounce of potassium bromide. This solution can be used repeatedly until the action becomes too slow.

Blackening Solution—Dissolve one hundred grains of silver nitrate in ten ounces of distilled water, using a large graduate. In another, smaller graduate, dissolve a small piece of potassium cyanide, possibly an eighth of an ounce, in three or four ounces of water. Now add to this the cyanide solution very slowly, a little at a time. This causes a white precipitate in the silver solution at the instant, which disappears when stirred with a rod. Keep slowly adding the cyanide solution until it no longer dissolves and there remains in the silver solution a *very little excess* of precipitate. Be sure not to overdo it. This silver blackener can also be used repeatedly.

Put the negative to be intensified in a tray with the mercury solution and allow it to remain until whitened through to the back. Wash well under the tap, and then flow over the surface with the blackener. As soon as the negative is entirely blackened, plunge it under the tap and wash well. Do not let this blackener remain on the negative longer than is necessary; otherwise the density will gradually reduce again. This intensifying can be repeated if needed, washing well between each operation.

For reducing density on dry plates, the so-called Farmer's Solution is probably the most useful all-around preparation. It is a combination of potassium ferri-cyanide and hyposulphite of soda. As the solution in combination is quite unstable, it should not be prepared in advance. Formulas are so plentiful that it is not necessary to repeat here.

Both intensifying and reducing, however, are to be avoided as much as possible; and if the photographer pays careful attention to the temperature of the developer and observes the exact time required for proper density in the negatives, there will be very little occasion for after-treatment.

Dry plate work is so systematized now-a-days, both in the plate manufacture and in the compounding of solutions and the methods of exposure and time development, that the work is comparatively simple; but, in wet plate work, the photographer has to rely wholly upon himself. Men of fair intelligence and without chemical knowledge are doing this work every day with reasonable success; yet, there is no doubt that if an operator understands the chemistry of the wet-plate process, he will average better results than the fellow that works blindly.

To prepare a silver bath and keep it in good condition, is a subject worthy of considerable study. Likewise, to prepare collodions and have them in harmony with the bath, is something that requires thought. To be sure, one can buy ready-prepared collodions that work quite satisfactorily with the average forty-grain bath, and such collodions can be purchased cheaper than they can be made in the shop, which condition is because of the revenue tax on alcohol and the circumstances that govern its sale.

In the matter of developer for wet-plate work, it is well to procure a large stone crock, to fill it half full of iron sulphate, green crystals, and then fill the crock with water. Also put into this crock a few pieces of metallic iron which tends to keep the supersaturated solution in better condition, although this is not absolutely essential.

To make up developer for use, take a quantity of the stock and dilute it with water until it tests 20° by the ordinary hydrometer, and to every quart of 20° solution add about three-quarters of an ounce of glacial acetic acid. The acid retards the action of the iron; more or less acid is required, according to temperature, and the action should be noted. Commercial acetic acid can be used, although a larger quantity will be needed, and that glacial acid is better and quite as cheap in the end.

To prepare a new silver bath, get ten gallons of pure distilled water and be sure that it is distilled properly and that it is not a simple filtered spring water which is sometimes sold as distilled water. Buy ten or twenty pounds of silver nitrate, recrystallized. You will need it all, eventually, and it is a little cheaper to buy in quantity, more particularly if you watch the market and buy when bullion is low, for the price of silver nitrate is governed by the price of silver bullion.

Pour four gallons of distilled water in each of two wide-mouth silver bath bottles and add to each about three pounds of silver nitrate which, when dissolved, should test with the argentometer about forty grains to the ounce. If there should be a little variation you can add more water or more silver, as the case may be, to make the solution register correctly.

Forty grains to the ounce is considered the proper strength for a new bath and this strength should be maintained as nearly as possible. The proportion by parts is one of silver by weight to twelve of water by measure.

Make up a ten-per-cent. solution of potassium iodide in distilled water—10 grams iodide to 100 c. c. of water—add 4 c. c. of this solution to each gallon of silver bath and about 5 drops of C. P. nitric acid to each gallon, and the bath should be ready for work. If it does not work perfectly clear a few more drops of the acid may be added; but this must be done very cautiously. It is necessary to slightly iodize a bath before it will work properly, and some operators prefer to coat a large size plate with collodion and let it soak in a new bath until the iodides are absorbed from the plate.

A new bath should work several weeks with hard usage provided an operator will take the trouble to add a little pure silver solution each day to keep up the strength and that he is cleanly and careful in all other respects.

When the bath gets surcharged with alcohol, so that the developer does not flow evenly over the surface of a plate, it is time for renovation; and, if the following plan is adopted, troubles will be almost entirely avoided:

Pour out the bath into the porcelian evaporating dish and let it simmer over the gas flame for an hour or more. Keep it below the boiling point of water, for alcohol is evaporated at a lower temperature and it is only necessary to remove the alcohol and not necessary to reduce the bulk of silver bath.

When the solution is cool enough after evaporation, pour it into the wide-mouth glass bottle and add to it a small quantity of a ten-per-cent. solution of potassium permanganate, stirring briskly while doing so. When the solution is a pale violet color, set the bottle in the sun and let it stay as long as possible. When there are several baths, keep them in the light all the time until wanted for use again.

The action of the permanganate is to neutralize the bath and to combine with any accumulated organic matter which will deposit as a black powder in the bottom of the bottle, to be afterwards filtered off. When filtered, the bath should be re-acidified with nitric acid as before. If the bath is not neutralized with the permanganate or some other agent, it will not do much good to put in the sun, for organic matter will not fully precipitate in the presence of an acid.

After the lapse of some time, a bath becomes surcharged with iodides. The excess can be removed in the following manner: In an empty silver bottle, put about a half-gallon of distilled water and pour the silver bath into this water. The bath will turn milky immediately, indicating precipitation, and this precipitate can be filtered out. Observe, that the bath *must* be added to the water, not the reverse, otherwise the iodides will not be so efficiently removed.

The iodides should be removed when necessary, before evaporation of the bath, and the permanganate treatment follows as directed.

Do not boil a bath away, because it is unnecessary; do not fuse the silver, for thereby come countless troubles—"oyster shells," solarization, etc. Treat the baths as directed and there will not be any annoying interruptions of work.

With few exceptions, intensification of wet-plate negatives in halftone or line, is done with copper-bromide and silver. To make the copper bromide bath, take enough of the copper sulphate stock, from the saturated solution kept in one of the earthenware jars, to make a quart, when diluted to register sixty by the hydrometer, and enough of the potassium bromide stock, kept in saturated solution in a large glass bottle, to make a quart when diluted to register thirty by the hydrometer, and mix these two solutions—the copper and the bromide. The chemical combination takes place immediately and the bath can be used right away, although it is generally considered to work better after it has stood for a day or two.

A point to be noted, right here, is that after bleaching a wet-plate negative with the copper-bromide, it should be washed to remove all excess of solution but should *not* be washed more than is necessary, otherwise the density will be impaired.

Silver is required for blackening copper-bleached negatives, and this silver solution should register thirty grains to the ounce, and preferably be made acid with citric acid. The acid can be omitted or other acids may be used, and many pay scant attention to this; nevertheless, in using citric acid there is less danger of stain and therefore it is better to use it.

Iodine and iodide for the "cutting" and "trimming" operation is prepared as follows: Water, eight ounces; potassium iodide, four ounces; dissolve, and then add two ounces of iodine, resublimed. This is a stock solution to be reduced as desired.

Potassium cyanide stock is kept in a large bottle and at a saturation point; by observing this condition an operator soon learns exactly the needed amount of dilution for the particular operation in hand. Remember, also, that potassium cyanide is a *deadly poison.*

For final blackening of the negative, sodium sulphide is considered the best for both halftone and line work, but for continuous tone wet-plate negatives, use ammonium hydrosulphuret, which gives a softer, more harmonious tone. One thing, especially, that should be observed is that either of these odorous agents should be used outside the dark room, because of the probable effect of the fumes on the silver bath. The blackening should be done at the outside sink where the intensifying also belongs. After blackening, the negative should be flowed with a weak acid solution to clear it up; then well rinsed under the tap and put in the rack to dry.

With all the care that may be exercised in the preparation and use of bath and chemical solutions, there may yet occur annoying failures if proper attention is lacking in the cleaning and albumenizing of glass, and we cannot do a greater service in connection with wet-plate photography than to emphasize the importance of this operation. *Clean glass,* and an intelligent, careful boy or man to see that every piece *is* clean, will do much to keep things going.

Most places use a big acid-proof tub with a strong nitric acid bath in which glass is soaked for a while, after which it is washed under the tap, scrubbed with a brush, rinsed, flowed with dilute albumen and put in a rack to dry. When carefully done, this works fairly satisfactorily; but many prefer two baths—one in which Babbitt's lye is dissolved and one for the nitric acid.

All glass is allowed to soak over night, at least, in the lye bath, after which it is washed under the tap and then put into the acid bath to remain as long as possible. Finally it is washed and scrubbed again, paying careful attention to the rough edges to remove *all* dirt. It is then flowed twice with albumen and put in a rack to dry, away from dust and fumes.

The white of one egg to fifty ounces of water is about right for the albumen coating, and a few drops of glacial acetic acid in the solution improves it.

The preparation of rubber solution and collodion for stripping is not so important a matter as the compounding of photographic chemicals; nevertheless there is a right way to do everything and adherence to formula is always desirable.

It has been quite the custom, up to within a few years, to buy the commercial rubber cement and to dilute it with benzole to the proper consistency for flowing over the negative. This works satisfactorily and is probably as cheap as anything else. In the early days, virgin rubber dissolved in rectified benzole, with sometimes the addition of chloroform, was used in the belief that anything else would react on the negative; but through experience this has been proven unnecessary. The solvent used in rubber cement does not cause any trouble, although in most instances it is carbon bisulphide.

The quality of the film for stripping really depends on the collodion, the purpose of the rubber being to prevent the stripping collodion from dissolving the negative collodion film.

Stripping collodion is prepared from ether, alcohol and soluble cotton in the following manner: To 32 ounces of alcohol add 320 grains of soluble cotton; shake for a moment, to thoroughly soak the cotton, and then add 32 ounces of ether; finally add to the 64 ounces of collodion three drams of castor oil. Allow the whole to stand a day or two and decant for use.

Wet-plate negatives that are not to be stripped, can have a protective coating of gum arabic in water, flowed over the negative before it is dry. If many prints are to be made from a single negative, however, it is better to varnish with a spirit varnish of which the following is an average formula:

Alcohol, 95%	24 ounces
Gum Sandarac	4 ounces
Oil Lavender	3 ounces
Chloroform	1 ounce

When the photographer has finished the negatives and they have been stripped into position, or properly protected if no stripping is necessary, they are then passed to the plate-making department where the artists do the opaqueing, spotting and squaring, preparatory to making the print on stone or metal. This work must be most carefully done, or there will be extra labor on stone or plate that is more costly. If necessary, the artist can coat the back of the negative with ground glass substitute, and do a limited amount of retouching to reduce any tones that may be too strong; but there is a limit to the possibility in retouching a half-tone negative. Ground glass substitute may be purchased ready for use, or it can easily be made after published formulae in many photographic annuals. It is repeated here for convenience:

Dissolve one ounce of gum sandarac and one-quarter ounce of gum dammar in eleven ounces of sulphuric ether and then add about six ounces of pure benzole. Test by flowing over a plain piece of glass and, if the grain is not coarse enough, add a little more benzole until the desired grain is obtained. The amount of benzole as against the amount of ether governs the grain and it is not always possible to state in advance the exact amount of benzole that may be required. The tests soon enable one to adjust matters.

To print from the properly prepared negative on to a stone surface is a very simple operation, but at the same time, one that requires care and judgment. Fine-grained and blue hard stones require a thinner solution than coarse-grained and yellow porous stones. A good printer always takes this into consideration, and from experience learns just what is the right consistency of solution to fit the conditions. Generally speaking, it may be said that hard stones require a solution about one-third thinner than that for soft stones. The following is a standard albumen formula for printing solution made purposely heavy to be diluted as required:

Dry flake albumen	1 ounce
Water	8 ounces

Let soak until entirely dissolved; and a good way to do this is to put the albumen in a piece of cheesecloth and suspend it in the water, occasionally shaking or moving it about. This requires some time, because the dry albumen is slow to dissolve.

Ammonium Bichromate	75 grains
Water	4 ounces

Dissolve and add to the albumen solution and then add to the whole enough liquor ammonia to make distinctly alkaline and turn the dark yellow solution to a light straw color. Filter this solution carefully.

It is not necessary in coating stones to use a whirler; in practice the following method works admirably:

First, rub the stone over with a piece of clean soft cloth to remove any possible dirt, and then pour over the surface clean boiling water enough to thoroughly warm the stone. Immediately flow over the sensitizer, twice, and set the stone on edge to dry, of itself, in the dark. The stone will be ready for a print in a very few moments.

It is necessary to provide a number of wood screw clamps such as are used by cabinet makers when glueing up joints. Also to have a wooden block or a box about six or eight inches square and about a foot high that is fastened firmly to a rather low solid table, to be used as a "roll-up" table. Place the sensitized stone on the wooden block; lay the negative in position on the stone; put over this a clean piece of quarter-inch plate glass, the same size as the negative; adjust four of the wood clamps over stone and glass and screw up tight to get *good* contact. Expose, on an average, three minutes, to an open arc lamp. Remove the clamps, glass and negative, and roll up the surface of the stone with a good crayon ink to which has been added a *very little* transfer ink. Get a thin, even coating of ink, fan dry and then put the stone under the water tap and develop with a tuft of cotton. When development is complete, blot off the surplus water with clean paper, fan dry, and the print is ready for the artist to work on, or it may be prepared for etching and transferring if no art work is required.

If the photographic print is a part of a color job to be, and offsets are required for other colors, make silver prints on the stone from the negative, which not only assures the fitting, but gives the artist a better image to work over. Make up the following three solutions separately:

A

Iron and Ammonia Citrate, green crystals	110 grains
Water	1 ounce

B

Tartaric Acid, powdered	18 grains
Water	1 ounce

C

Silver Nitrate Crystals	45 grains
Water	1 ounce

Mix A and B and then add C very slowly, stirring briskly with a glass rod.

To coat a stone, wet a piece of absorbent cotton with the solution and rub over the surface quickly and evenly, going both lengthwise and sidewise until the surface looks smooth. So little solution is used that the stone dries very quickly. Printing before the light should be continued until the exposed edges of the stone show a dark bronze-brown color. The stone should then be washed under the tap for a few moments and then flowed over several times, with a solution of hyposulphite of soda, one to fifty. This is allowed to act long enough to clear up the image, which time can be judged by the appearance, after which the stone is washed for ten or fifteen minutes, blotted off and fanned dry.

This silver image does not interfere with any of the lithographic operations, nor will it lose its quality unless the stone is exposed to the sunlight for some time. Photo-printing on metal differs very little from printing on stone, other than that uniformity of solution consistency, for plates of average size, should be maintained. Generally speaking, the formula as given will do for metal printing if the amount of water is made 24 ounces instead of twelve. Take a piece of grained zinc a little larger than the image on the negative, allowing margin enough for the transformer to work from the plate. Counter-etch this plate with a little acid and alum, wash carefully and flow over with the albumen solution at least twice. The first time flowing will carry the surface water before it and this should be allowed to go to waste, but the second flowing may be saved by running off into another bottle to be afterward refiltered for use again.

At present, the average exposure required for a four-times enlargement is better than twenty minutes, using a powerful arc lamp of thirty-five amperes. It would be of considerable advantage to cut this time in half.

The following formulas for quick-acting solutions have been used with good results, but all are based on old theory.

A German Formula:

A

Take 100 grammes of Cologne Glue in 600 c.c. of water and melt over a water bath.

B

Dissolve 4 grammes of dry albumen in 30 c.c. of water.

C

Mix A and B and heat over water bath until the albumen coagulates and clarifies the glue, then filter this solution.

D

Dissolve 70 grammes of dry albumen in 60 c.c. of water and add 120 c.c. of solution C, after which add 60 c.c. of a 10 per cent. solution of Ammonium Bichromate, which should be done in a weak or non-actinic light.

This does not require any ammonia and is a fast solution, relatively speaking.

The clarification of the glue is undoubtedly a good thing and the glue solution will remain in good condition for some time, if kept in a cold place.

The addition of glue to the albumen solution has its advantages, but we seldom resort to clarification, preferring rather to use Le Page liquid glue. Possibly, however, there is a slight gain in clarification which may be due to the preservatives used in the Le Page glue. The liquification of this glue is probably accomplished with chloral hydrate, and there may be some salicylic acid used as a preservative; but whether these have a tendency to retard the light action is an open question.

Another formula for a printing solution, by Dr. Albert, is to dissolve 120 grammes of picked gum arabic in 100 c. c. of water, to which add 10 grammes of sugar and 10 grammes of ammonium bichromate. This solution prints fairly quick but requires special treatment in development, which is accomplished with a 1 to 30 soap solution. The soap solution should be used cautiously and preferably should be prepared from soft water and glycerine soap.

Another gum bichromate solution that has more speed than the above is prepared as follows:

Water	630	parts
Ammonia bichromate	21	"
Sugar	7	"
Chromic acid	7	"

Add liquor ammonia slowly to clear the solution.
Let it stand over night; filter and keep in the dark.

Parts as given in this formula are the equivalents of cubic centimeters and grammes.

In all formulas that call for the albumen of fresh eggs, it is well to use eggs, for, where extra speed is concerned, fresh albumen has some advantage; but for contact printing the dry albumen is quite as good, more economical and convenient.

Stock solution of dry albumen that will keep for a considerable time can be made in the following manner:

Dissolve 140 grammes of dry flake albumen in 1000 c. c. of distilled water and add to this 2 grammes of carbolic acid crystals. Let this stand for twenty-four hours and then filter carefully.

To make a printing solution, take 500 c.c. of water; add 50 c. c. of albumen stock solution and 5 grammes of ammonium bichromate, and add just enough liquor ammonia to clear up the solution.

Nearly, if not quite all, the prints that are made on metal, are made on zinc, although sometimes aluminum is used. Treatment in either case is about the same, other than that aluminum needs to have a thicker solution than zinc. This is due to two causes—the natural porosity of aluminum and the generally sharper grain.

One thing greatly in favor of zinc is the fact that it may be procured from many more dealers than can aluminum. In fact, when it comes down to an absolutely accurate statement, there are only a very few users of aluminum who do not get their sheets from the one source. There are several mills in the country making zinc sheets and it is no trouble to find a dealer who is glad to supply zinc sheets to lithographers.

Commercial photographers are beginning to take notice of the fact that photo-lithography is growing faster than any other part of the graphic arts, and are looking into the prospects of the future along that line. They can make negatives as well as any one, and a great deal better than most practical photo-lithographers, but when it comes to making the plates they are actually at sea in the matter. It has come to their notice that they are losing a great deal of business because they cannot make plates as well as they can negatives and it is to be expected that many of them will set about learning the plate making end of the business, and then the work of the photo-lithographer will be helped materially.

As has been said time and again, photography is, beyond question, the very foundation of lithography, and photography has been given very little attention by the lithographer until recently. Now the trouble is that good photographers who know something about making plates are scarce, otherwise there would be many more photo-lithographic shops in the country. Every shop where photo-lithographing is done should encourage apprentices and every commercial photographer should endeavor to learn plate making. The future will prove the value of this advice.

There has recently been manufactured and placed on the market machines for making transfers on printing plates for the offset press. These machines are very fast and accurate, and save money as well as time for the operator of the offset press. It would be impossible to describe all of these machines in the space devoted to transferring in this book, but the best of them will be found in the advertising columns of lithographic trade papers. When installing an offset plant machines for making transfers should be investigated.

TIN PLATE DECORATING

TIN-PLATE Decorating is essentially an offset proposition. As matter of fact tin printers were the first offset lithographers, and while it is a well established fact that Ira Rubel, the acknowledged discoverer of the offset process as applied to paper, never saw a tin-decorating press, the fact remains that long before he applied his process to printing on paper, the tin decorators of the country were printing on tin in exactly the same manner as he proposed to print on paper.

Few people outside of the tin-decorating business have ever been in a shop where this work was done, and even the paper lithographers have a very vague idea as to how the result is accomplished.

Tin plate decorating had been developed in France to a commendable degree prior to 1870; and in 1872 a Mr. Baber, an Englishman, returned to England from France with a process which he had developed from his experience in that country, and started a tin-plate decorating shop that is still in existence. There is some question as to just when the process of printing on tin was originated, but it is certain that it was a long time before offset printing on paper was thought of.

The sheets of tin plate used for printing upon lithographically are made in two standard sizes: 14x20 inches and 20x28 inches. A commercial box of the former size contains about 112 plates and weighs about 108 pounds. Although these metal plates are commonly called "tin plates" this designation is a misnomer, as they are really thin sheets of rolled steel, coated all over with a layer of molten tin deposited on them by a dipping process.

The raw material from which these plates are made consists of long flat bars, about nine inches wide and three-quarters of an inch thick. These are first cut into lengths of fourteen inches. These short bars are then heated to a white heat and passed through a rolling mill until they are reduced to the proper gauge. After the plates are rolled to the required gauge they are given an acid bath which renders them susceptible to the tin-coating process. Tin is a metallic element and its melting point is 446 degrees.

After the acid bath preparation, the steel plates are dipped into vats of molten tin, which dipping is done by means of a clever mechanical contrivance which picks up each sheet separately and dips it automatically edgewise into the vat where it receives its coating. It is then ready for the artist and designer.

The artist possessing a training in tin plate work will reproduce a color design that will embody the best technical printing features which might otherwise be disregarded by an artist trained in other kinds of lithographic work.

A technicality occurs in drawing color work for tin plate decorating; a white printing is involved, as is also a lacquer or gold printing. These two printings used in conjunction are utilized by the artist to produce buff or flesh tints, and sometimes orange and yellow effects, according to the shade of lacquer employed. This lacquer, being translucent, provides the gold effect when used alone upon the bare tin.

Although the plain lacquer method of gold printing is the established and most perfect one for tin plate printing, metallic bronzing upon tin has been done, similar to the paper method of this process, but the bronze powder is likely to ruin the rubber blanket in the subsequent printings. Considering the cost and trouble of this kind of bronzing, it places it in an unfavorable position for general practice.

It is as well to here specially emphasize another technical feature in connection with the drawing of the color forms for tin printing where they are identified with the running through of these specified colors a second time; so that where stipple, or fine line shading, is drawn in, conjointly with the solid portions of the plate, this shall not suffer from the double printing operation. The heavy masses of the work present little or no tangible difficulties in themselves when run through a second time; but where a fine or graduated stipple display is incorporated with them in surrounding portions, then a thickening, or coarseness is apt to be produced when the second, or repeat, impression of this color is made upon the tin, owing to the difficulty of preventing spreading of this stipple when overprinted a second time upon itself.

If the artist studies this peculiarity when drawing the original color forms, and makes an allowance for it in the texture and disposition of the stipple scheme put in, an otherwise preventable disfiguration may be avoided in connection with this double printing of these body colors. If this is not done, then it is customary to remove the stipple and fine line work, or shading, after the first run through of the color, and then to run the solid masses only, upon the second occasion.

It is frequently a difficult task to remove this shading skillfully, unless the artist has previously considered this point in the formation of the stipple combination with the solids, so that it is easy to remove without leaving an angular or crude junction between these two formations. Where, however, it comes to the removal of detached groups of stipple, such as the shading upon the cheeks of a figure, this is easily accomplished. But where on the other hand it comprises a vignetted background, terminated with heavy solid masses of work at the outer margins, it is a very formidable task to detach the stipple shading work from the solid without deteriorating the composite effect of the two, and leaving a harsh line of demarcation, after the color has been printed the second time.

In connection with the production of designs for tin-plate printing purposes, there are occasions when old designs can be utilized without the need of reversing, such as is embodied in a general landscape or seascape illustration, where no lettering or figures appear in the view, in which case it rarely matters whether the right or left view of the original is presented.

In another class of work—that of the cheapest kind—in which only a black or blue printing is done upon a colored ground, a special solid color is printed upon the plain tin, or rather is coated upon it by means of the special type of varnishing machine. These stoving enamels may be either white, yellow, light blue or red, etc.

Here, in connection with this class of work the artist department is only called upon to produce the design-printing form. The other is merely a solid decorating color which serves as a background for the design or descriptive matter. The same proviso applies where a solid lacquer forms the background upon which printed matter has to appear.

If the photo-lithographic method is used, the direct photo-litho image should be produced by means of a negative taken without the aid of a prism or mirror; but if supplied with a photo-litho transfer by either the bichromate or ferric salts method, the prism or mirror should be used to save the prover unnecessary work.

Grained paper drawings (or those done upon the "Norwich films" consisting of translucent material with a grained surface) need particular care in transferring and proving. The damping must be just sufficient to prevent puckering before running down, or softening the composition too much to stand the pressure in transferring. On the other hand, if not sufficiently moistened it would not adhere securely to the stone or plate when being run down.

If this class of transfer goes down patchy, it is a defect which becomes intensified when re-transferred and the subsequent printing upon the tin-plate is carried out.

Much of this chalk work is drawn direct upon the grained stone, in which case the prover gives the work the preliminary acid-gum etch. There is not the same danger with this, as all the finer tones are upon the actual printing surface; whereas when drawn upon the grained paper, they have to be gotten down by transferring, in which a very small error of judgment may either lose these tones altogether, or else thicken them up inordinately.

Place the finished film, after drawing in the damp book, with a sheet of thin tissue paper over the ink-drawn surface, and leave there until the moisture has just caused the least feeling of tackiness upon the surface to appear. Then slightly moisten the stone surface upon which the transfer has to be made—with this proviso, however, that you employ less moisture than you would in transferring transparent transfer paper down. It will be remembered that we have divided the moisture up into two drafts, one on the film itself, and the other upon the surface that the film has to be attached to; consequently neither surface requires as much as it otherwise would if it were the sole recipient of the transferring moisture. When the transfer is run down by repeated pullings through, the surface of the stone receives a preliminary gumming-up with a very weakly acidulated gum solution. This, after drying, is washed off and replaced with a thin film of pure gum arabic solution, and fanned dry. The job should now be washed out with a litho "mogul" fluid, when it can be treated with the ordinary procedure of make ready.

It will, of course, be understood that if the proofs are done upon paper instead of tin-plate, then the objects of the design will appear reversed in the matter of right and left views. This is, of course, apparent where lettering or figures play an important part in the design.

Now in making the proof direct upon tin-plate, the question of drying assumes another aspect, as the inks are reduced with more viscid fluids, such as copal varnish and gold size; and are also subject to stoving.

The prover should keep a tabulated record of each color used in a job and of the particular colors and varnishes used in compounding. This information is also a guide to the pressman. The chart may be written upon the back of one of the proofs or on a separate sheet attached. As for example:

PROVER'S COLOR AND SEQUENCE CHART.

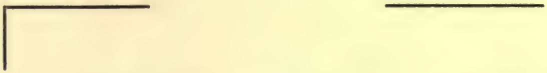
NUMBER	COLOR	HOW COMPOUNDED AND REDUCED—INGREDIENTS
1	Yellow	Lemon No. 1 and Primrose Yellow, reduced with thin Varnish and Machine Oil.
2	Green	Primrose Yellow and Chinese Blue, reduced with S. Varnish and Oil.
3	Red	Madder and Crimson Lake and touch of Scarlet, reduced with Varnish and Oil.
4	Black	Ordinary Press Black and about ¼ Bronze Blue added.
5	Flesh	Madder Lake, Scarlet Venetian Red, and Burnt Sienna.
6	Dark Brown	Black, Orange, Burnt Umber, Red.
7	Light Blue	Chinese Blue and tint varnishes.

NUMBER	COLOR	INGREDIENTS
8	Light Brown	Similiar to Dark Brown, but greatly reduced in strength.
9	Dark Blue	Bronze Blue and touch of Royal Blue.
10	Pink	Madder Lake, reduced with tint varnishes, etc.
11	Light Gray	Oriental Blue and touch of Black with reducants.
12	Dark Gray	Sepia, Chinese Blue, Varnishes, Driers, etc.

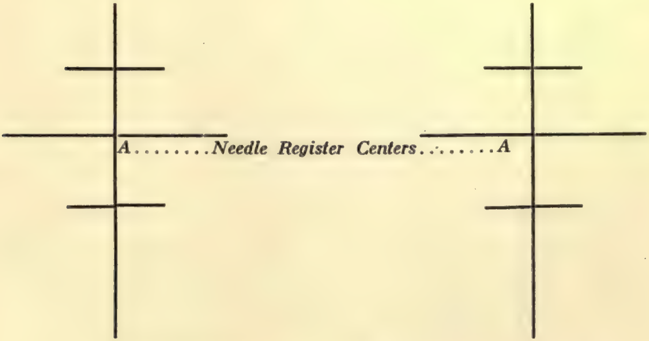
If the inks are purchased ready made, the prover may specify which make of inks he used in making up colors.

Register Methods

IN producing a paper proof of tin-plate work, the prover has a choice of two methods of getting his lay for register. He may either employ the corner lay method, by means of corner lay rulings as in accompanying diagram:—



or he may use the more precise needle-point and centre-hole registration method as in the subjoined diagram.



In the lay register mark method, there is a further and more accurate form of lay edge, the method of cutting a right-angled opening in the proof sheets flush up to the centre register mark, and using these cut edges for the lay guide.

These lay register methods are generally used for rapid proving and for medium grade work; the needle point method being the most accurate and skillful one, and which is invariably utilized for the highest classes of chromo work.

In making a proof upon tin-plate, the reducing of the colors would be somewhat different; copal varnish and gold size would supplant the sperm and machine oils, etc. Lacquer inks of the required hue would also play an indispensable part of the list, while the white pigment printing also takes its place in conjunction for chromo work. Where the job is only a two-color one, or perhaps a solid lacquer printing with black descriptive matter printed on top, then the white printing is not required.

The artist draughtsman generally likes the first proving to be done upon paper, as he can then better see the sketch and its general chromo-litho characteristics which effect the drawing, in comparison with the water color the white paper background affords. The white printing form in this case is omitted, as the paper itself supplies the white. The lacquer also is only used with the object of creating its effect when covering the lustre of the two surfaces.

Sometimes decalcomanie proofs are prepared for transferring to tin plate, by the use of duplex or direct coated decalcomanie paper, in which case the prover has to reverse the order and sequence of printing his colors, the lacquer and the white being applied last: so that the order of printing would be: first gray, then in their sequence—light blue, light red, dark brown, dark red, dark blue, yellow, lacquer, and metal. The basic white may have to be printed twice, according to the nature of the job and design, and the covering power of the pigment.

The prover should slip-sheet his proofs right up from the first color, as this serves a double purpose and benefit—first, it preserves the proofs from the influence of undue contraction due to exposure to the variations of atmosphere and moisture; and secondly, it avoids set-off in which the backs become soiled, and rob the proof of some of its color impression; while further, the proofs are kept much cleaner and crisper by being kept in tissues all through the proving operations. An unsmoothed brown paper serves as the best slip-sheet and can with care be used indefinitely for the same purpose for subsequent jobs.

There is another process that the prover is frequently called upon to perform in tin-plate work, and that is transposing an image or type matter from black to white. This is the procedure in which type matter becomes white lettering in the metal print, and a design becomes a white image, or a colored background image, instead of a colored line or stipple image.

For sharpness and accuracy, photographing from negative to positive photo-plate is superior to any other process.

Another method is to dust pulverized gum acacia upon an impression of the job and then treating it as a transfer. This is the quickest and cheapest method, but does not produce the sharpness secured by photography.

A prover should not employ methods to produce proofs which cannot be imitated on the press when the edition is printed.

The prover is a very vital part of tin plate decorating shop. Unless his work is done with the utmost accuracy the pressman who tries to print according to the proof finds himself up against a mighty hard problem. A careful, intelligent prover is a part of the business that cannot be dispensed with, for upon him depends the "proving" that the colors selected will do the work required.

* * *

The Presses

THERE are two types of machines used for tin-plate decoration—the flatbed reciprocating and the rotary. The flatbed is the original, of which there are several modifications. The modern tin-plate printing presses are generally constructed with the two printing cylinders of equal dimensions and these will offset on metal plates at the rate of from 3,500 to 4,000 per day. Some of these machines are built with a sloping feed board. The lower cylinder in both patterns is the one which carries the rubber blanket (usually three-ply) and it is upon this that the ink impression is first made from the stone or printing plate, in order to offset it upon the tin-plate.

It was here that lithography for the first time evolved the ways and means of printing expeditiously upon a hard metallic surface in a manner equal to printing upon paper without coming into actual contact with the printing plate or stone. In this procedure there is no deviation from the principle of lithography. The difference is a mechanical one only, being a medium for transferring (offsetting) an impression from one hard, unyielding surface to another of the same nature without impairing either in the transaction.

An early difficulty in tin-plate printing (one that is still present, but in an infinitely less degree) was that of the scratching of the printed work during printing. To obviate this the vertical feedboard was devised which enabled the tin plate to be fed into the machine without scratching or rubbing the previously printed work upon it. Revolving rubber rings now also play a protective part, and safeguard the image during printing; while the relation of the pitch of the upper cylinder to the grippers and vertical feedboard is such as to conform to the most convenient line of action while maintaining the printed side of the tin plate, face outward.

The arrangements for delivery vary upon the different makes of machines. Some have an automatic delivery on to traveling belts which in turn carry them to the end of the machine for racking.

The common feature with these delivery methods is that they deliver the printed tin-plate face upward as a safe-guard against injury to the wet ink impression. The racking is done by hand assistance.

Considering the item of pressure it is important that this should be carefully maintained by turning the spring partially around every two months or oftener so as to prevent undue strain and equalize any possible distortion. Some spiral springs governing the pressure are better tempered than others, and the lower grades soon lose their elasticity, causing imperfect impression.

The gripper edge over which the rubber blanket has to be drawn should be rounded off to save the blanket from being indented and ultimately frayed.

The blanket tightening bar should be absolutely true to line so that an equal strain is exerted the whole width of the blanket.

Tin decorating presses are not made in extreme large sizes, but ordinarily take in a plate 24x33 inches or 32x43 inches. The accessories which come with the machine usually are one set of leather riders and steel riders; a rubber blanket; automatic damping apparatus; automatic moving side-lay; spanners; oil can; single driving gear, and belt shifter.

Sets of rubber rollers for color work from zinc and aluminum plates are "extras;" but machine attachments, such as the "double inking" or "double rolling" mechanism, are considered as integral parts of the machine.

Some tin-plate printers have made it a practice, when printing difficult forms and refractory colors, to improve the lifting qualities of the image by etching it up into a certain amount of relief, in order to cause it to lift better without having recourse to extra pressure, as in the preceding reference.

This etching up into relief has its disadvantages, as it indents the rubber blanket, and thus causes a defective surface after a short period of the pursuit of this practice. Care must be exercised not to etch the printing form image too deeply, so as to save the blanket from being permanently impressed.

There is always a danger of getting too much relief if a soft stone is being used, as the action of the acid is more effective than when a darker and harder stone is employed. This defect is intensified with long runs, where the pressman may have occasion to re-etch the stone at the end of the day, or two or three times during the course of the run; by which time the work has gradually been forced into fairly high relief. In the case of aluminum plates, the very nature of the metal acts as a safeguard against this defect. With zinc, no troublesome relief is encountered, if a non-corrosive etcher has been employed, instead of a corrosive one.

For certain classes of common work where the job is limited to two or three colors, and where metal plates, either zinc or aluminum, are used instead of the litho stone, it is customary to economize in the size of the plates employed for this work, and consequently a 17x22 zinc plate may be used upon a 20x30 machine, the plate necessarily being worked loose at the back edge, as it is not sufficiently large to admit of fastening in the back clamps. So long as the gripper edge of the plate is secure, satisfactory register may be depended upon.

The trouble, however, that it is desired to draw attention to, in adopting this method, is, that the back edge of the plate causes an indent in the blanket, due to this abrupt edge having to sustain the whole weight of the pressure, as it is being borne off the extremity of the plate during each rotation of the cylinder.

These indents, accruing from the plate edge, are irreparable, and show, as a distinct white line, right across the work, whenever a larger plate and work is employed in connection with this blanket. It is, therefore, very important that the tin-plate printer, inexperienced in this method of working, should be fore-warned of the outcome of its ultimate application, and of any remedial measures that may be taken to mitigate the trouble that ensues from its adoption.

Although the upper and the nether cylinders of the flatbed machines may be clothed with rebounding materials, the major importance of blanketing proper, centers around the rubber clothed lower cylinder, so far as the impression perfection of the print is concerned.

The upper cylinder affords a much larger latitude in the variety of materials available for its covering; such as American cloth, or rubber materials, etc., provided it is tolerably uniform in substance and character, and is possessed of reasonable durability under working strain.

* * *

Rubber Blankets

TOO much stress cannot be laid upon the importance of securing a good quality of rubber blanket for tin-plate printing work. It should be free of defects, such as unevenness or variation in thickness of substance; as these shortcomings tend to alter the arc of the periphery in those particular areas, and thus cause a bad fit and register, as well as variation of ink impression.

Old stock blankets which have been kept in store for a long time, invariably show a perished condition soon after being brought into active use, the surface cracking into tiny fissures, which render perfect work an impossibility, no matter how skillful the pressman may be.

The light colored rubber blankets are more favorable for revealing unevenness than the dark ones are, when the test impression is made with dark colors, on account of the greater contrast which is thus afforded. Irregularities of surface to the minutest degree can be seen, although the lesser forms of such are negligible.

In attaching the blanket, an important item is to substantially strengthen the fixing-rod holes of the gripper-edge margin of the rubber blanket. This may be done in a variety of ways, such as by gluing on two narrow strips of firm canvas along each side of that portion of the blanket edge which fits in the cylinder aperture, so as to strengthen it, and thus prevent any bulging out under the strain of tightening of the punctured support holes. Under no circumstances should the support of the blanket in the cylinder depend upon mere punctured holes alone, without a rod support.

The gripper edge of the rubber blanket upon a flat-bed machine is usually the first portion to show the effects of wear and tear; due to the recurring rotating impact, and contact grip which it sustains with the stone or plate at each revolution of the cylinder. When this has occurred, it is best to change the blanket around, so that the back edge now becomes the gripper edge, and the faulty gripper edge falls free of the back portion of the work. Another alternative is to cut off the faulty part, and then use the blanket for a smaller size machine.

Where stones are used, it is incumbent upon the pressman, that he shall see that the edges of the stones are carefully rounded off, so that the blanket is spared the destructive influence of a sharp gripper-edge, which first causes an indent, and then a fracture.

One of the most difficult blanket troubles to rectify quickly and satisfactorily, is the development of a viscid or sticky condition of the rubber, either in the form of clingy patches, or in a more general state over the whole surface. Wherever this particular blemish does occur, there the surface of the rubber is incapable of taking up the full amount of ink from the printing form; nor can it retransfer it as well to the material that has to be printed upon. It is therefore necessary that this defect should be grappled with at the very earliest stage of the development; otherwise it becomes progressively worse.

First, the whole surface of the blanket should be washed with a good rubber wash, and time allowed for the volatile constituents of the wash to evaporate from it as much as possible. Then the defective, soft, spongy portion of the surface should alone be dusted over with flour of sulphur, so as to cause it to become charged with a layer of the finest particles of this powder. There are two ways in which this sulphur powder can be conveniently applied; one, by retaining the powder in a fine muslin bag, and dusting it on to the affected portion of the blanket by dabbing; the other, by applying it on with a pad of cotton wool, just as French chalk is applied. Whichever method is followed, it is necessary to point out that the tin printer should take every precaution to prevent loose fibres of the material becoming attached to the sticky surface of the blanket, otherwise he will be troubled with a blemished impression, which in many cases will necessitate the rewashing of the blanket and the repeating of the dusting-on procedure. A final dusting with French chalk powder all over the blanket completes the operation.

If the above procedure is pursued for a number of times, both at noon and at the close of the day's work, during the first visible signs of this trouble it will arrest its further advance, and partially restore it to its original state.

A modified application of the foregoing treatment is followed by some pressmen by mixing the sulphur powder and the French chalk together, and dusting on in that manner. If this method is adopted shortly after a new blanket is brought into use, it acts as a form of preservative, and conserves the blanket from degenerating into the afore-mentioned sticky state.

Age-tarnishing of the plates, such as is likely to occur with old stocks of tin plates, are generally the most formidable form of manufacturers' defects that the tin printer has to grapple with. In tin plate chromo printing, the same as in transparency work in paper printing, a basic white printing constitutes the foundation of the design. The white form, therefore printed first, has to establish a suitable groundwork for the colors. Similarly as when printing lithographically on black textile fabrics, a white base has to be printed first, so in tin printing the metallic sheen of the tin must be suppressed by a layer of white pigment (in imitation of white paper) before the proper color effects can be obtained upon it.

This white printing, then, appears practically solid all over the base of the design, except where lacquer has to be printed to form the gold portion of the design; and also where, in special circumstances, its omission is required for the purpose of differentiating the effect of the solid colors. There, those portions of the image are left blank in the white; so that the tin shows plain in those portions. Thus, wherever the transparent lacquer pigment is printed upon the plain tin, the lustre of the metal acting in conjunction with the lacquer, produces the characteristic gold work of tin-plate decoration.

The other exception, in which the white is omitted, is where any special colored portion of the design is desired to appear as a colored bronze pigment of metallic sheen.

To give a concrete example of this: An ornamental design may have portions of the solid work in, say the burnt sienna, printed upon the bare tin surface, with the white left out there beneath it entirely. This treatment will give a bronze-color effect of a most pleasant metallic lustre, while another portion of that same color, if printed upon the white ground, would there appear as a sienna color purely. A similar result applies to a violet magenta; a transparent green; a madder lake, or any other pigment possessing similar fairly good degrees of transparency.

The printer, therefore, has to be thoroughly vigilant during the printing of the white form, to see that it does not scum, or the work thickens appreciably: otherwise the lacquer printing will overlap it, and produce a buff effect; while in the case of other colors, they would be deprived of their bronze character.

In order to obtain a substantially opaque white basis for the colors, the white form has generally to be printed twice; sometimes three times. This superposition of the selfsame image upon itself so repeatedly tends to produce a spread or thickening of the white printing. A small provisional allowance for this peculiarity should be made by the artist when drawing the form.

Another deviation that the young tin-plate printer will frequently meet with, is in connection with the lacquer form. He will sometimes notice that the lacquer work has been drawn to underlay some of the solid colors, such as reds, browns, orange and black. This is done where an exceptional depth and vigor of effect is being sought. It will moreover necessitate his watching the drying of the subsequent colors much more closely.

Where an orange-toned red is required in local portions of a design, it is customary for the yellow to be drawn and printed solid underneath the red; so that the printer may probably have portions of the same red form yielding quite different effects upon the tin plate, due entirely to this underlying influence of other colors in some portions of the design, and their absence in others.

Where silver work has to appear upon a design, the printer needs to be very careful to make sure that no tinting or scum of any of the preceding colors is allowed to establish itself, or encroach upon this portion; as the bright silver effect depends upon the absolute purity of the unalloyed sheen of the metal itself prevailing.

Where a maximum effect of solid color printing is sought for, such as an intense red background, etc., it is customary to print the red form through twice, in order to build up the desired strength of color. The difficulties that the printer here encounters are manifold: If he attempts to run the plates through a second time before the first layer of red is dry, then he will find that the blanket will not yield the second film as completely as it did the first. He will also notice that there is a tendency for the impression upon the blanket to thicken and smudge, due to some of the color of the first impresison being returned from the tin plate. Where there is fine stipple work in the form adjoining the solids, there the printing surface is apt to suffer degradation, as it presses out upon the plain interlying spaces of the stone or plate, causing greasiness or scum. It is therefore best to see that the first print is dry before commencing the second one.

Further, he must not alter his register of the first red printing after he has started, or the fit for the second time through will be out of register; and, if there should be fine lines or light shading, the effect of these will be lost by bad register.

Lithographic inks for tin-plate printing must not be worked "sloppy" and loosely thin as is sometimes done in paper printing; on the contrary, they should be maintained as self-supporting as the character and nature of the work will permit. It must be borne in mind that all the reducants used in tin-plate work have necessarily to withstand heat. There are as many as five different grades of litho varnish available for metal-plate work — "Tinting," "Thin," "Middle," "Strong" and "Extra Strong." These do not include oxidizing varnish reducants, such as copal and gold size, nor dryers, such as boiled linseed oil which is easily the first favorite.

A careful mental reflection in regard to tin-plate printing inks will remind the studious printer that they are required to serve upon a most dense and hard surface, as compared to the infinitely softer and absorptive one of printing paper. Necessarily, a very much thinner film of color can be satisfactorily laid upon the tin-plate surface; such a condition, however, imposes the necessity of tin-plate inks possessing a much more concentrated covering power, and their constituent particles being ground to the finest impalpable state. These conditions being attained, a thinner film of ink may be expected to afford as much color value as a thicker one without these conditions. This implies that cheap and nasty inks should not be used for metal decoration work where permanent and satisfactory results are sought.

The one-time suggested practice of using a siccative white as a reducing dryer for all colors, with the object of dispensing with the process of stoving, is a short-sighted one, and one that is fraught with more troubles than appear upon the surface. Each color printed upon the metal plate, must dry sufficiently firm to enable the subsequent printings to be done upon it efficiently. At the same time it should not possess a hard, thick, glazed, skin-like surface; such a condition prevents the other colors that follow from lifting. The film of color printed should be as receptive as can be secured, compatible with the work to follow.

Where a condition of flinty, hard, drying is produced, then each separate color lies more in the form of a distinct layer; instead of being amalgamated and intermingled as it were, in order to form the secondary hues of the combination. At the same time the printer must guard against an attenuated thinness of film, or the printing will look washy and lacking in vigor. Any color which, under the influence of the stoving heat, or the reducing mediums, should show signs of volatilization or dissipation, should be rigorously discarded in future selections.

Body colors, when reduced down to the working state, should possess a crackling sound, when briskly pressed out with the palette knife upon the ink slab. For want of a better expression, the term "buttery" is often employed to indicate the material state of the color, when in the most satisfactory condition for tinplate work.

The lacquer colors are put up in various shades to imitate every hue of bronze powder. They are designated as pale gold lacquer, copper lacquer, citron gold lacquer, etc. Any of them can be mixed together in varying proportions to suit the requirements of the work, if the use of a single one of them does not produce the particular hue required. As the true metallic effect of these pigments depends upon the combination of the metallic sheen of the plate surface with the lacquer itself, they are necessarily of a transparent character when distributed out to their working consistency and fullness of film upon the printing form.

Lacquer inks do not, as a rule, require any driers added to them to expedite their drying, as the very nature of the basic substances from which they are made (shellac, etc.), ensure their accomplishing that part of the printing requirements, without trouble. A simple reduction with litho varnish, and a touch of oil added, for the purpose of weakening the inherent powerful oxidizing properties of these substances, invariably proves to be ample treatment for lacquer inks; and they are usually among the best working ink substances of the tin printer, in addition to being the most rapid self-drying printing pigment that he has at his command. In regard to the red pigments, it will be found that the most brilliant ones are invariably the most difficult workers. Tinting or staining are their frequent attributes; and in tin printing, this weakness portends more trouble than when occurring in direct paper printing methods. It is here that the "metallique" plate pressman has to bring all his resource of technical remedies to bear upon the trouble. His first thought must be the printing ink. He will have to add something to fix the coloring matter more firmly to its base. Camphor, silicate of soda, beeswax, Canada balsam, ropy varnish, etc., are all antidotes, and must be apportioned in quantity and kind to suit the actual extent and scope of the particular color under treatment.

His next consideration must be the damping water. Here he should aim at getting the maximum of hydroscopic properties, while using the least possible volume of water upon the printing surface. Molasses, brown sugar, glycerine, salt, etc., are all helpful mediums in this direction, if used in strict moderation. Some pressmen are apt to be too liberal in the use of these reagents; with the result that very soon the remedy becomes worse than the ailment.

A sure help to minimize this tinting trouble of the colors in tin-plate printing, is to keep the plain, uninked portions of the printing form as rough as possible.

White is another pigment that is always a difficult one to manipulate in tin printing, on account of the inherent drawbacks which it possesses, combined with the very stringent conditions required of it in metal decoration work.

Every lithographic printer knows the all powerful influence which the hue of the paper has upon the contrast and brilliance of the printing colors of the job, and its general resultant effect as a completed whole.

All good white dull enamel paper yields a sparkling, and crispy contrasty result, which it is impossible to attain when the same colors are printed upon a buff tone, plain paper surface.

And so in tin printing; the white base upon which the colors are to be printed, has to serve the same function as the white paper does in chromo printing.

If the white should be of a dull grayish tone, instead of a sparkling, snow-like white, then the chromatic effects of the finished work will be of poor range and ignoble contrast.

It is impossible to get brilliance without a full scale of contrast. To attain this, the white printing must be pure and clean, as well as solid and dense. In order to attain the maximum depth of white ground, it is necessary to print it through two or more times. Much depends upon the character of the white employed, and the fineness to which it has been ground, as it must be free of coarseness or grittiness.

Now as to the peculiar character of the whites. We know that zinc white is of a more permanent character than the lake or dead white; at the same time it has not near the same covering power or opacity. Consequently, the glittering surface of the tin plate is not as well obscured with the same number of printings.

There is, however, the obverse side to these special features of the whites, *i. e.,* their stability under the influence of other colors superimposed upon them, and the change capable of being wrought in them by the varnishing process employed in general tin-plate decorating.

Flake white is the most popular white pigment for metal decoration, for many reasons; but even this varies in character with different manufacturers. One great fault which this white possesses is its heavy character. This feature induces a separation of the pigment matter away from the vehicles in which it is incorporated. These varnishes and oils, being so much lighter than the heavy pigment mixed with them, enable the lead pigment to sink through them, and thus quickly accumulate and coagulate upon the rollers and inking slab. Then faulty distribution ensues, and uneven printing.

Here are a few technical tips that will be welcomed by the lithographic printer entering upon tin-plate work, commencing with the white printing: First, the white should never be used alone, without being tinged with a small quantity of mauve, which removes the yellowness and gives a more snowlike hue to it.

It is surprising what an amount of tinging it will stand; experience will soon apprise the amount to add.

It should be the rule when printing the white through the first time, that the tin surface shall still be faintly visible through the layer. The second time through there must be a heavier layer printed on; so that a good ground shall be obtained. Often it may be necessary to put the white through a third time, particularly when the white is printed solid upon the tin, and no lacquer is being worked.

In printing the solid white all over the tin-plate, the dampers are removed, the plate or stone inked up solid and the impression made upon the rubber blanket. It is surprising what a small quantity of color is necessary, compared to what the printer has been accustomed to in direct printing upon paper.

Although the plates are stoved after the first layer of white is printed upon them, the second printing can be proceeded with before the first layer is fully dry. There must, however, be some dryers added to the ink at the start. Before commencing the colors following the white printing, the white must be properly dry. It is frequently necessary to stove the plain tin before printing on the white, to dispel the damp and remove the chill. Perhaps the most practical way of reducing the white sufficiently for working is to use equal quantities of thin litho varnish and boiled oil, plus the dryer. Flake white is usually a good dryer, but still it is necessary to help it to dry.

Many devices have been tried at various times to produce an improved method of printing the white.

At one time a layer of zinc white was first printed, and then this was followed by a layer of lead white in succession, but the extra expense of cleaning up and the risks of chemical reactions, nullify any tangible advantages that could otherwise be advanced for this procedure.

In certain centers of the continent of Europe it used to be the practice to print the white through once, after which it was dusted over with some finely pulverized powder white. Subsequently a second printing of the white was resorted to. This method also fell into desuetude.

Sometimes there may be two separate forms for the white, after the first has been printed, a second one with additional work upon it may be needed, in order to obtain a varied effect in both the lacquer combination and that of the other colors.

In the general run of color work, the lacquer printing generally follows the white in tin-plate printing. This pigment plays an important part in collaboration with the white, as well as forming a basic printing upon the metal also.

Practically all hues of gold effect are attainable by a judicious admixture of the various shades of lacquer pigments, while its utilization upon the white printing as an overlay may serve as either a flesh, buff or dark yellow coloration. The use of stipple or line shading in the drawing produces a varied effect.

The outcome of printing such characters upon a solid white base, produces an intermediate tone effect quite different from where it is drawn full solid to print upon solid. Splash work still again works another modification.

The lacquer should be worked much more firm or stiff than most of the other colors on account of the tendency of this pigment to "scum" or work "greasy" when reduced to a soft state.

In printing tints, white should always form a component part, unless the underlying colors would be adversely affected by such addition.

Practically all colors should have a proportion of dryers added to them according to their innate degree of slow oxidation.

For some classes of work it will be found that thin litho varnish will suffice for many colors, in the reducing of them down to a working state.

The following chart shows results of prolonged tests of colors under heat (stoving):

Burnt Sienna stands 180° Centigrade without change, and is permanent to light.
Vermilion Red stands 100° Centigrade, browns a trifle, fairly permanent.
Crimson Red stands 120° Centigrade, changes a little, fugitive.
Violet Magenta stands 110° Centigrade, blackens a little, fugitive.
Yellow Chrome stands 120° Centigrade, browns a trifle, permanent.
Oriental Blue stands 120° Centigrade, blackens a little, permanent.
Bronze Blue stands 120° Centigrade, blackens a little, permanent.
Black (machine) stands 180° Centigrade, no change, permanent.
Green stands 130° Centigrade, tarnishes a little, very fugitive.
Pale Gold Lacquer stands 120° Centigrade, browns a trifle, permanent.
White stands 80° Centigrade, browns considerably, fugitive.

Useful Information, Solutions, Formulas, etc.

ETCHING and other solutions used in offset printing are supplied by those who manufacture the various plates, and it is well to use such, and follow out the directions given by the manufacturers. It is only reasonable to suppose that those who have passed through the experimental stages should be able to give the best means to attain the desired end. A little experience in working some modifications of the appended recipes will very likely be found to answer as well, if not better, than attempting to carry out literally the directions given; careful observation and practice will greatly assist the lithographer in these matters.

There are various solutions necessary for the proper working of metal plates. They are not of a complex nature, but at the same time it is imperative that they should be carefully attended to, if successful printing from these plates is to be obtained. For those who wish to prepare their own plates the following formulas are given:

When the plate has been roughened and attains a smooth, even grain, the following solution is prepared: Concentrated solution of alum, 20 parts; phosphoric acid, 2 parts to 20 parts of water; or alum solution, 10 parts, gallic acid, 15 parts; nitric acid, 2 parts to 30 parts of water.

After the transfer, the plate is gummed and then etched with an etching solution consisting of 10 parts of gallic acid, 2 parts of phosphoric acid, 10 parts of gum solution, to 30 parts of water; this being allowed to act for 30 to 40 seconds. The photographic lithographer will frequently require the lithographic tusche for additions or for corrections. The tusche must be tolerably brittle and dissolve in distilled water and flow fine and clean from the pen. These ingredients should be melted together by boiling: 2 parts of yellow wax, 2 parts of mutton tallow, 6 parts of Marseilles soap, 3 parts of shellac, and ½ part of lampblack.

A good autographic ink which draws in brown may be obtained from the following formula: 10 parts of Marseilles soap, 10 parts of tallow, 12 parts of shellac, 12 parts of yellow wax, 5 parts of mastic, 4 parts of asphalt, 3 parts of vinesoot, to 125 parts of water. Originals prepared with this ink transfer as well immediately as after several months, and ordinary well-sized writing paper can be used for drawing or writing on.

Fatty crayon used in photo-litho work is composed of: 30 parts of wax, 24 parts of Marseilles soap, 4 parts of tallow, 1 part of shellac, and 6 parts of lampblack, while lean crayon consists of 12 parts wax, 8 parts Marseilles soap, 2 parts tallow, 10 parts shellac, and 4 parts lampblack.

Any good transfer ink can be used for a developing ink, as this is applied with a roller. It usually consists of equal parts of tallow, wax, soap, some resin, and as much lithographing ink as all the other ingredients put together.

Thin developing inks can be prepared by diluting good transfer ink with equal quantities of wax, benzine and turpentine.

The following formulas are given for etching or desensitizing solutions: Original etching solution: 12 parts gum solution and 1 part 20 per cent. phosphoric acid. This is a weak etching mixture, and a few drops of red ink should be added to color it, so that it may be easily distinguishable from the stronger solution.

A Transfer Etching Solution: 8 parts gum solution and 1 part 20 per cent. phosphoric acid.

Both of the above formulas should be prepared two or three days before they are required, and well shaken or mixed before using.

An Aluminum Counter-Etching Solution: Add crystallized oxalic acid to a pint of warm water till a saturate solution is obtained; that is, until the crystals have ceased to dissolve. Then mix 4 parts of this acid with 96 parts of distilled water.

A good cleaning preparation may be obtained by pulverizing finely 4 parts of crystallized oxalic acid and 4 parts Sienna, and dissolve in water. Apply with quill or glass hair pencil. Concentrated sulphuric acid may also be used as a cleaning preparation.

An Acid Bath, consisting of 1 part nitric acid, 45 per cent. (must be free from chlorine) and three parts water, is very good; or the following may be utilized as a substitute: 3 parts nitric acid, 45 per cent. (must be free from chlorine), 5 parts fluorsilicic acid, and 42 parts water.

As a washing-out fluid, melt over a moderate fire these ingredients: 10 ounces of yellow wax, 14 ounces of Venetian turpentine, 4 ounces of tar, and 18 ounces of the best black ink. When the whole is melted and in a liquid state, add, while stirring, 36 ounces of pulverized asphalt, dissolved in 1 pint of benzoline. The mixture is then diluted with 10 pints of turps and is then ready for use. For a smaller quantity than the above recipe, the proportions may be halved or quartered.

The following recipe for the same liquid is given by another expert: Dissolve 1 ounce of wax, 1 ounce of stearine, 2 ounces of asphalt, 1 tablespoonful of terebene, 1½ pints of turpentine, and ½ ounce of re-transfer ink.

The reader will notice that in the recipes for the washing-out fluid there are two distinct classes of ingredients. First, the grease solvents; secondly, the greasy bodies which do not evaporate, but will, with the aid of the solvents, be spread over the work, which thus receives a coating of greasy matter which strengthens the transfer, and enables it to take on more readily the ink for further preparation, while, at the same time, the dry gum still remaining protects the other parts of the plate, so that they do not receive grease from the solution.

An affinitizing bath with the following constituents is recommended: 6 ounces of nitric acid, ½ pound of powdered alum, to a gallon of water. The alum is best dissolved in warm water.

To etch after the drawing has been laid down this solution is suggested: Equal parts of ammonium silicafluoride and ammonium nitrate.

Another good metal plate etching solution is:

Nut gall solution	10 ounces
Gum arabic solution	20 ounces
Phosphoric acid	¼ ounce
Nitric acid	½ ounce

The strength of this preparation can be altered to suit the plate.

The best wash-out fluid for the transferrer is said to be the following formula:

Asphaltum powder	1 pound
Beeswax	¼ pound
Tallow	¼ pound
Turps	5 pints
Benzole	1 pint
Oil of tar	¼ pint
Lavender oil	1 ounce

This liquid solvent when sprinkled on the roller, softens the black ink, and the effect is to render a less adhesive substance, making it more readily imparted to the greasy transfer image.

Taken altogether, the very best etch for zinc plates so far discovered is a solution made up as follows: Nitrate of ammonium, 21 parts; bi-phosphate of ammonium, 20 parts; gum arabic, 200 parts, and water, 750 parts.

Lithographic printing inks are generally stiff and strong in body when received from the makers and require to be reduced before they are used for printing purposes. The medium of reducing them is principally varnish, which is used in several degrees of consistency. It is prepared in various ways, but for lithographic work that obtained from the best linseed oil alone gives excellent results.

There are various kinds of gums, gum-resins and resins, all of which are the products of different trees. To the eye some of these resemble each other so closely that it might be difficult to tell the one from the other. There is, however, this remarkable difference in character that the gums proper are all soluble in water and insoluble in spirits; while the resins proper possess exactly the opposite quality, being soluble in spirits and insoluble in water. These two opposite properties are invaluable in the lithographic process. The gum used for lithographic purposes should be pure gum arabic, sold, it may be, under different names which generally indicate the district from whence it came.

A gum solution should not be allowed to get sour, which it will do in eight or ten days in winter and half that time in summer. There are certain preventives, such as the addition of a little camphor, carbolic acid, or the essence of cinnamon; and there is a remedy for the sourness when it has taken place, in the addition of a little powdered chalk. But by far the safest plan is not to allow it to get sour at all. This is easily effected by dissolving only a few days' supply at a time and keeping the sponges and pot perfectly clean. The action of sour gum is most detrimental to good work.

To ascertain the good quality of printing ink, you have merely to take a sheet of unsized paper and spread a little of the ink to be tested upon the surface. Some hours later the ink will be surrounded with an edge formed by the varnish. When the ink is good this edge is invariably white, and, on the contrary, when bad it is of a more or less deep yellow color. Such ink could not give satisfactory results in printing. This yellowness is sometimes due to defective boiling of the varnish or imperfect calcination of the black employed. These remarks do not apply to cheap, common inks, but to inks of some value.

Good offset ink should be black, brilliant, unctuous, too thick rather than too thin, and should dry rapidly. The finer an ink is, the better its siccative properties. Petroleum should never be added to ink to make it less strong. The degree of strength or excessive siccativeness can be reduced by mixing varnish with the ink.

Photo-litho transfer paper is, of course, in every respect a specific article, the coating of which consists of a gelatinous emulsion, which can be readily sensitized, and upon which a photographic image can be developed. Special preparation and manipulation are therefore necessary in connection with its production.

Good recipes for paste and glue, which are the result of experience, are here given: Dissolve half an ounce of the purest white glue in half a pint of rain water and add four ounces of the lumps of gum arabic. This is a good glue for pressmen and for general purposes. To make it pliable for setting gauges and for bookbinding, where a quick-drying glue would not answer, add a little glycerine. You can whiten common glue by adding oxalic acid.

A fire and water-proof glue is a handful of quicklime mixed with four ounces of linseed oil, thoroughly mixed, boiled to the consistency of syrup and spread on thin plates in the shade. It hardens and is then dissolved like common glue, when it is ready for use.

A fire, water, weather, acid, and rust-proof cement that can be used to fasten nearly every imaginable substance—metal, glass, wood, etc.—is litharge and glycerine mixed to the consistency of thick cream. The mended or joined articles should not be used for from a day to a week, according to quantity of cement used, as it is a slow drier.

A fine paste—none better for bindery and press work, especially for rotary presses—is made by mixing good flour with rain water, rapidly boiling to a paste and adding a little carbolic acid, the best preventive of souring. Do not use alum, acetic acid or borax, as some do, for this purpose. Strain the paste through a very fine sieve and it is ready for use.

Tusche, or litho drawing ink, is something that every lithographer should know thoroughly. The main thing is that it should contain fat and soap; the first substance is put in for the purpose of resisting acid, which must be applied to prepare the clean litho surface upon which it is used; the second substance is placed there to combine with the plate or stone, through the action of nitric acid, into a saponacious material, resulting in that strong, permanent hold which the work then obtains. In order to fulfill this requirement, the soap used for making such ink should contain the greatest amount of oil in combination with alkaline bodies; or, in other words, fatty acids, and for this reason Marseilles soap, which contains nearly 20 per cent. more of this acid than the ordinary soap, is preferred by some in making this ink or litho tusche. In addition to this there is wax, or spermaceti, added also for their greasy qualities; further, shellac, pitch and mastic, to help bind the first-mentioned material together, and finally, as it would be impossible to draw fine lines, dots, or close textures with an almost colorless fluid, lampblack, in its finest state of reduction, is added simply to give color. The greatest amount of care should be exercised in the mixing, owing to the diverstiy of the substances used.

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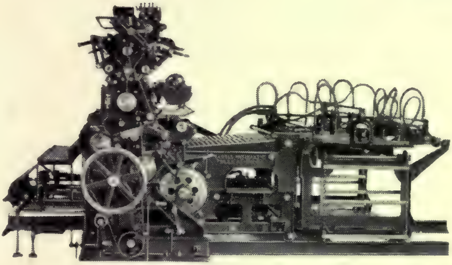

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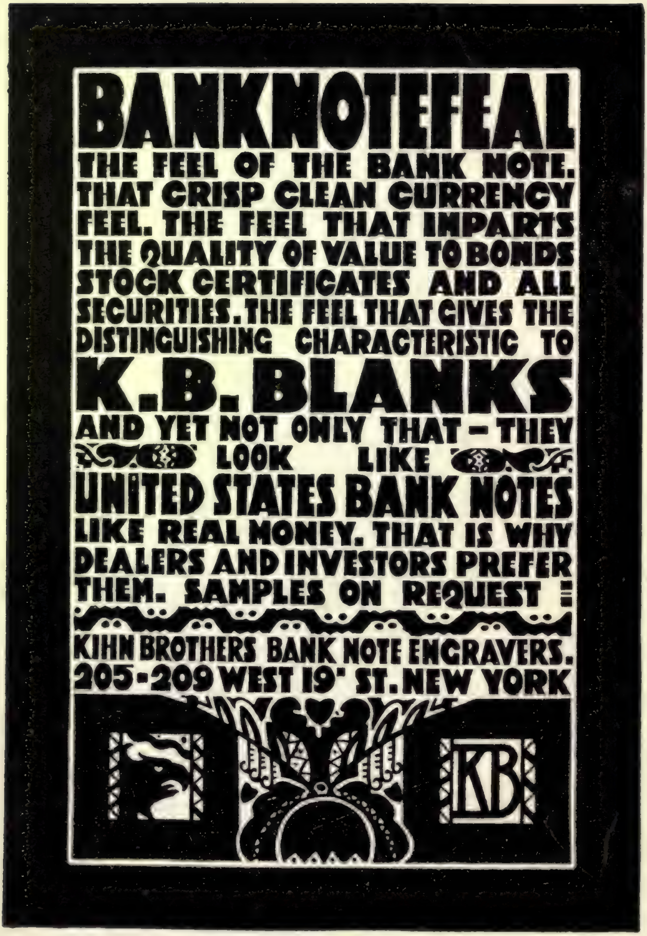

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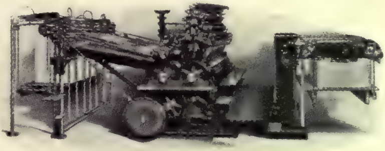

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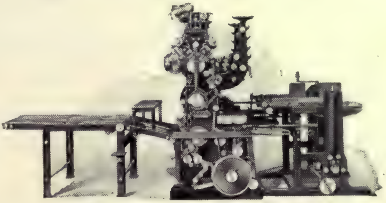

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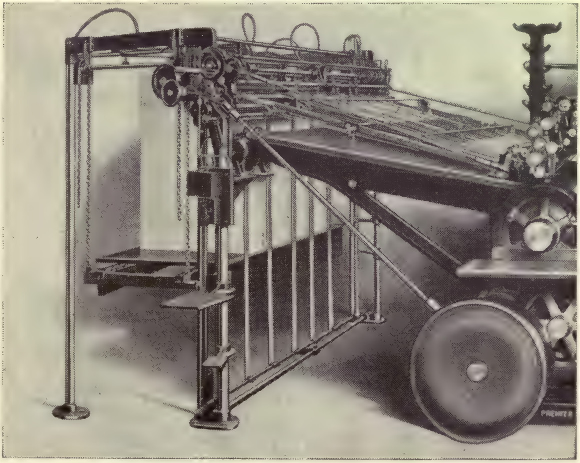

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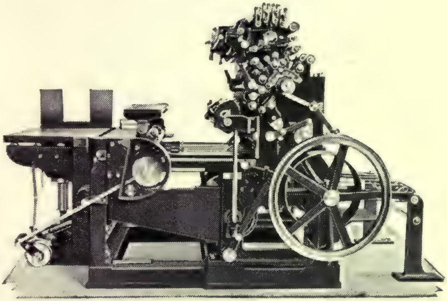

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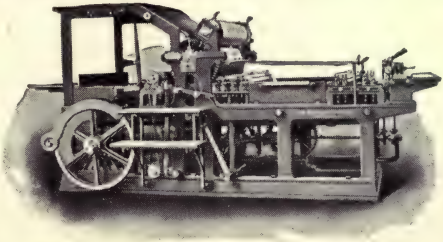

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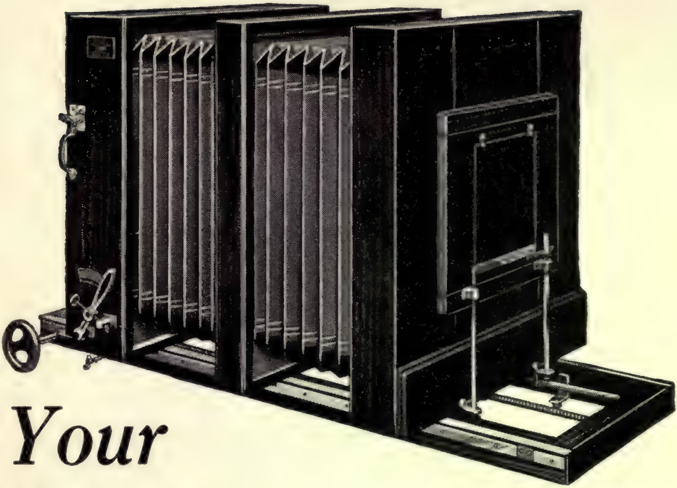

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